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MAY 27 1918

ON THE CONTROL OF INSECTS AND FUNGI.

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By Fred Reinlein,
Portland, Oregon.

CIRCULAR No. 151.

JULY 20, 1917.

ERATTA:

Several unfavorable conditions, largely caused by the war, combined to make it impracticable for me to read proof of this Circular. The result is, it contains considerable typographical errors. Taking the Circular as a whole I find that these errors do not lead to any misunderstanding. On page 12, paragraph 3, mention is made of an 'insect, admittedly extremely injurious.' By this is meant the pear thrips. On page 32 you find 'The Cain Borer' for 'The Cane Borer,' also below, on same page, 'sweet and sour-sweet' for 'sweet and non-sweet.' On page 35 you find 'large pole pines' for 'lodge pole pine.' On page 36 'broadly impossible' for 'blandly impossible.' On page 37 'millions of feet' for 'billions of feet.' also 'preventative war' for 'preventive work.'

On page 39 'left us available places' for 'left no available places.' On page 34 it reads 'these savings' for 'these sowings.' Quotation marks have been left out in a number of places where they should have appeared.

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ON CONTROL OF INSECTS AND FUNGI.

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Circular No. 151.

July 20, 1917.

Inasmuch as anything new pertaining to agriculture cannot be satisfactorily introduced unless it can be shown that the matter had been submitted to the Department of Agriculture for examination, and had there been approved; it follows that it is the duty of the Bureau of Ethnology to define its position in regard to anything new that has bearing on the control of insects.

I have been wanting the Bureau of Ethnology to define its position on new matter for 19 years past. What the Bureau at present is wanted to act on is set forth in my Circulars No. 148 to 150. There was no action of any kind whatever taken on my Circular No. 148, nor on those preceeding, as far back as No. 141. This was due, as explained in my Circular No. 150. to the failure of the Chairmen of the Congressional Committees on Agriculture to do their duty.

With the appearance of my Circular No. 149 Senator Geo. E. Chamberlain of Oregon was asked to see to it that the Bureau either admit that I am right, or else show wherein I am wrong. As explained on page 18 of my Circular No. 150, Mr. Chamberlain was fair enough to give me a look at the two replies he received, which showed that the Bureau had done neither of the two, but had handed him out a bundle of lies in each case.

Since Senator Chamberlain did not see to it that he got any desired information on any given point the matter was taken up with the congressman from the district I then lived in, Hon. W. C. Hawley, as stated on page 19, of my Circular No. 150. He too, got first of all, a bundle of lies.

Circular No. 150 was meanwhile gotten out to explain in handy form just what the Bureau was most wanted to take action upon. Mr. Hawley was asked to see to it that action was taken,

and here is the essence of the reply he got. "The suggestions made by Mr. Reinlein in this circular (150) have been examined by the experts of this Bureau, who are of the opinion that they are impractical."

It is all a lie. If the experts had investigated the suggestions they would not now want to hand out an opinion, for they would then positively say what their investigation had shown. An opinion, as used in law, is the formal decision of a judge or counselor; not a mere claim as is the statement of the Entomologist; but the claim is substantiated by giving the reasons upon which the claim is based. Members of Congress can be expected to know this.

For an illustration of how the Entomologist's claim works out, take the description of the control of the range caterpillar, as given on pages 1 to 3, of my Circular No. 150. The Bureau has virtually nothing in the way of control that is tangible. They expect to control the caterpillar by natural enemies—parasites and predatory insects, saying the value of the crop is too small to allow of the use of artificial means, in the sense this form is generally understood, which is true.

Having nothing better to offer than the development of parasites and predatory insects, and expecting this to solve the problem, or at least make this do to placate the population of the affected territory, is equal to claiming that it would be possible to control the codlingmoth or any other insect by this course alone. Man can merely assist in establishing natural enemies, which in turn are often decimated by enemies of their own. The means of control I suggested, first published in my Circular No. 146, issued Aug. 10, 1915, was calling for the systematic use of poultry.

This suggestion was new; and the Entomologist, assisted by his experts, could, without an investigation, right then have handed out an opinion, showing why they arrived at that opinion. They did nothing of this kind.

It had been shown to them that poultry could be made to attack the insect the year around, and it was shown to them at

the very beginning that poultry is not expected at all to control the pest by attacking the full grown caterpillar, studded with hairs.

Investigations, in this case, could have been begun at any day of the year, hence should have been started immediately.

Or, to put it another way for an illustration, the Entomologist wants to say, in this case, that his experts claim that poultry will not attack the egg clusters of the range caterpillar during the 8 months the caterpillar exists in this form. He wants to say that his experts claim, that as these egg clusters hatch and each egg develops into a little caterpillar a quarter of an inch long, poultry would not attack these young worms, that further, that these caterpillars while young, are gregarious and are nearly always exposed to view, poultry would not continue to eat these young worms in very large numbers. When present as pupæ this insect is greedily eaten by skunks, and the Entomologist wants to credit his experts with the claim that poultry would not eat these pupæ. Nor that they would eat of the moths, usually within easy reach.

As a field station was already established for the breeding of parasites, this investigation of the use of poultry could have been made in the easiest and most inexpensive manner.

As explained on pages 4 to 10 on my Circular No. 150, a judicious use of poultry can be made to absolutely control the bollweevil and the bollworm.

The Bureau's chief reliance for control of the bollweevil practically from the beginning has been the early burning of the stalks. As many farmers object to the burning, on the ground that it impoverishes the soil, the Bureau then conceded that it might do to cut the plants up with the stalk chopper, plow the trash under immediately and harrow and drag the ground "to make it still more difficult for the insects to emerge." You see neither the burning nor the burying kills any appreciable number of the adults. The burning has the advantage in that it kills the immature stages in the infected squares and bolls; while the plowing in buries these immature stages and because of the looseness of the soil due to burying so much vegetable matter,

many of these will mature and emerge before settled cold weather to successfully hibernate.

Again, these plants had been pumping water out of the soil very heavily for weeks, and the soil is apt to be very hard for anything like successful burying, and the work will be slow.

I had shown an improved way of securing the desired result, consisting in throwing the soil at the last two or three cultivations slightly towards the plant, sowing a cover crop, preferably a legume, vetches for instance, at the last cultivation, then cutting the plants off with the V stalk cutter when wanted, burning the plants, and then have thus at once the field produce pasture, recovering from the air all and more of the carbonic acid and nitrogen that was lost through the burning of the plants.

Since neither burning nor burying of the plants kills any noticeable number of the adults the Bureau at an early date suggested that some of the plants be allowed to stand as traps, and the wevil were then there to be killed with crude oil. It is hard to see how such a scheme could work, since the adult can readily fly off and being chittinous all over, they should be able to stand a good bit of oil. Of late years nothing was heard of it, the idea having evidently been found to be absolutely impracticable and ineffectue.

Up to 1913 the bollwevil was not known to feed on anything other than cotton. Since then there was noted a decided tendency of wevils to learn to feed and breed in plants other than cotton. As a consequence, as explained on page 8 of my Circular No. 150, I soon realized that by destroying the bulk of the plants and leaving a small part for traps, bending or rolling the plants down to bring the wevil within reach of poultry, the wevil would thus be exposed to attack till hibernation is fully under way, which in warm winters in the lower cotton belt does not occur at all, or is of very short duration.

This, as explained on page 9 of my Circular No. 150, led to the suggestion of growing small patches of very late planted cotton purposely for traps, and in turn it was found that such trap patches would equally well serve to control absolutely the bollworm at the same time.

With these trap patches in use a farmer may safely bury his plants if he prefers, since most adults resulting from buried squares and bolls would find their way to the trap patches to be picked off by poultry.

However, with a trap patch of late planted cotton on hand to attract and hold for poultry the wevils that will yet emerge from infested bolls and squares on the cut off plants, there is no need for the fertility destroying burning of the plants, nor for the cumbersome and doubtful burying. The burning of the stalks not only means a loss of organic matter contained in them but it means a much greater loss through the action of the fire on the soil. On the other hand the stalks, if left as they were cut off, will rot enough by becoming overgrown by the covercrop to cause no trouble when the covercrop is plowed in. The stalks thus act beneficially by lessening evaporation of water, by keeping a more even temperature, preventing erosion, especially while the cover crop is yet small, and finally furnishing humus.

Poultry can, under the supervision of man, be forced to patrol the cotton fields during the growing season as needed. Early in the season cotton fields offer very little inducement for wild birds to visit them: food being found much more readily elsewhere, especially in woods and orchards.

If a field to be planted to cotton is properly plowed well ahead of planting time, few if any wevils that may have been hibernating within will be able to emerge, and infestation will be from without. As long as there are no squares, these wevils all stay close to the edge of the field, feeding in the tips of the plants where poultry can readily see them. By the time squares appear, usually only about half of the wevils have yet emerged. On pages 5 to 7 of my Circular No. 150, you find explained in detail that wevils then promptly scatter over the field because they then want to feed and oviposit in squares, unless secured, by man under my former plan, and by poultry under my new plan, within a day or two after their arrival at the edge. Even then, however, infestation usually remains near the edge, gradually progressing all over the field as infestation increases. Thus it is doubtless best all around to leave the work of reducing the number of hibernated wevils to poultry.

With the wevils reduced the fall before through the use of trap patches, and such trap patches again coming into use, in due time, the following season, and poultry on the watch virtually at all times, there is no chance for the wevil, the bollworm and most other insects to appear in harmful numbers; all of which the Entomologist claims he has investigated and found to be impracticable. This when he has nothing to offer for his plan of hand-picking by man, after the wevils have scattered all over the field, is only "guardedly" recommended, so that he can make his get-a-way.

Cultivation destroys the natural home of wild birds. All the protection man can give under the circumstances is not sufficient to counteract the decrease in numbers thus occasioned. Again, since cultivation destroys the fruits and seeds many of these wild birds normally live on, they cannot increase in numbers sufficient to at least partly protect the cultivated crops, without being compelled to levy a corresponding toll upon the crops. The gallinaceous domesticated birds are developed from a species that was capable of ready flight, lived 10 to 15 years, the female laying a few small eggs each spring.

The domesticated kind, evolved by selection, being unable to fly to any extent, is thus specially fitted to work under the supervision of man when and where it is wanted, doing thus little or no harm, while doing good. And their number can be regulated by man entirely corresponding to the need for their services.

Thus, in the control of the three insects thus far mentioned, there does not enter the use of any artificial means, poultry, under the supervision of man, doing the work. Hence, this being a clear-cut issue, it would seem best to force the Entomologist to talk on these first.

I have shown in my Circulars Nos. 147 to 150 that there are many other insects where poultry can thus be used to best advantage, and quite a number where their use offers the only practical means of control. Grain and forage crops infested by pests, often can be similarly controled by poultry as is the range caterpillar, also it was shown that various caterpillars affecting

timber trees can be controlled by poultry when all else is impracticable, usually by the poultry scratching for their pupæ below the surface of the ground.

It is not often that an insect is exposed to view during all of its life cycle as is the range caterpillar, nor that it is within the easiest possible reach of poultry at all times.

The gipsy and browntail moth, considered as pests affecting woodlands, because of the loss value of trees grown for timber, call for inexpensive means of control. Farmers' Bulletin No. 564 issued in 1914, pretends to offer such means. As explained more in detail on pages 17 and 18 of my Circular No. 147, and on pages 7 and 8 of Circular No. 149, poultry can reduce the gipsy moth in woodlands through securing part of the eggs, securing some of the young caterpillars that fall off the trees or spin down, scrape out older caterpillars that hide at the base of the trees during the day, and secure some of the females before they oviposit.

In addition, since the males are strongly attracted to light, they could be trapped with a trap such as I offer. This point is discussed on pages 4 to 7 of my Circular No. 147. Also on pages 14 and 15 of my Circular No. 149, in discussing the control of the leopard moth it is shown how the apparatus shown on last page, or some similar make, can be fitted at small cost for a trap to catch these insects in large numbers.

Farmers' Bulletin No. 788, the leopard moth, on page 9, gives a good idea of what Chief Howard thinks makes a trap. He says: "To what extent electric lights are serviceable ... has not been definitely determined, a method frequently advised consists in placing shallow pans around the electric light poles to attract the moths; the pans are partially filled with water and a small quantity of kerosene is poured into them. The moths flying against the globes drop into the pans and are promptly killed when they come in contact with the oil."

As these globes are suspended about twenty feet above the ground at the intersections of the centerlines of the streets, or driveways in parks, I cannot see how "pans placed around electric light poles" could ever be close enough to the globe to catch

moth; and therefore, I contend that the advise is all drawn from imagination and that nothing whatever has been determined as claimed.

Also, Chief Howard does not want to talk about beneficial and neutral insects that would also be caught. When I sent my first catch—about 1500 insects. mostly ground beetles, which are, on the whole, beneficial—to the Bureau, Chief Howard said that if this is a fair sample of what the torch catches, its use should be prohibited by law.

To use any trap to advantage the user has to know at least approximately what kinds of insects he is catching, so that he may use the trap only when there is a paying catch of injurious insects being made. Assuming the Entomologist or someone else has a trap that works satisfactorily, it is the Entomologist's business to encourage its use and educate the public to using it. But with the Entomologist persistently claiming I am wrong all around, it is unwise for me to push the use of a torch for a trap and other matters, till other things not involving the use of any apparatus has been settled. On page 5 of my Circular No. 147, short reference is made to matter I published in regard to trap tests, made by the late Prof. M. V. Slingerland. Cornell University, Utica, N. Y. These tests showed that mere pans with water and kerosene do not catch anything worth while, and particularly nothing in the way of strong fliers, of which the leopard moth is one, and so is the male of the gipsy moth, and both sexes of the brown tail moth.

The method you find described by me admits the insects to the red hot burner through a ring of light about $1\frac{1}{2}$ inches wide. formed by two simple corresponding cone-shaped attachments placed at this distance apart, and because of the heat, the dazzling light—dazzling by comparison with the darkness outside—and the narrow space within, they become momentarily disabled and drop through a hole in the lower cone into a pail below. But where bright lights interfere, or if a wider range of attraction is wanted, as would be wanted in the case of timber insects in general, I would use something else.

The Bureau of Ethnology has no tangible means whatever

for controlling the gipsy moth in woodlands, except the breeding of parasites and predatory insects.

Since these parasites are admittedly equally subject to attack by natural enemies, they cannot, admittedly, be satisfactorily controlled by man.

The Bureau, because of this now proposes to give the advise to change as far as practicable the deciduous woodlands to coniferous ones, because the gipsy moth can live only upon coniferous after having passed the first two stages upon deciduous vegetation.

As explained on pages 2 to 5 of my Circular No. 148 and elsewhere, as there quoted, the pines of New England, and apparently all over the country, are now becoming infested by the European pine shoot moth. As this insect selects nearly always the apical bud for oviposition, if as yet uninfested, I had pointed out that pouring some semi-liquid clay into the apical cluster of buds before oviposition starts would protect it, the female then merely selectin a side shoot for oviposition.

The Bureau has no means of control. What they pass off as such is 140 years old and consists in removing the infected shoots. This, if the insect is at all plentiful, results in trees so crooked and dwarfed, dwarfed through the repeated destruction of the apical bud through successive years, as to possess no value.

This insect is night flying, and as near as can be seen a satisfactory trap is the only feasible means of reducing the number of the adults.

There is no assurance whatever, in fact all odds are against it, that it would be possible to make it pay to so keep down deciduous vegetation that there would not be plenty of food to enable the gipsy moth to pass through the first two stages. But even if this were feasible, the Bureau has no means of controlling the pine shoot moth, and wants to condemn the plan evolved by me.

For control of the brown tail moth in woodlands the Bureau likewise, has nothing to offer, but claims that "elimination of

oak, scrub-apple and wild cherry would greatly assist in reducing the numbers of this pest." (Farm Bull. No. 564, page 20). Oak is pretty hard to eliminate, and as the female can readily fly long distances, they simply would oviposit in orchards. Besides the caterpillar also develops very readily on plum and willow, also, for second choice, on elm and maple. In fact the caterpillar feeds generally upon all deciduous trees, on many shrubs and even upon herbage. (Farm Bulletin No. 264, page 16.)

It must be born in mind that for successful breeding little of the preferred food plants, such as oak, is needed to enable all the caterpillars hatching from eggs concentrated thereon to complete about one-third of their growth, after which time they can, by migrating, complete their growth on less suitable food.

As both sexes are strong flyers and much attached to bright lights, and because the females oviposit much more heavily in territory adjacent to bright lights, the most feasible means of protecting all of the valuable food plants thus affected would consist in trapping the adults at these lights. I have very definite ideas of how this could be successfully done, but with the Entomologist allowed to misuse his office I want to do nothing.

In woodlands, since these caterpillars frequently spin down, also often fall off, or blow off by wind, poultry would keep them at least partly under control. It is not known to what extent poultry can eat these hairy caterpillars, but there is very little doubt that they can stand considerable of the smaller size when taken along with other food. The trouble is, neither the Bureau of Biological Survey nor the Poultry Division of the Bureau of Animal Industry have any positive knowledge on this point to offer. If the Entomologist had wanted investigations to be made, and the point is he claims his experts made investigations of all of my suggestions, he had his own staff to do this quite easily.

On page 18 of my Circular No. 150 I stated that the alfalfa weevil is known to be readily found (and then eaten) by poultry. The source of information for this statement is found in Agricultural Bulletin No. 107, page 57, contributed by the Biological survey, 1914. The rather detailed evidence there given pretty conclusively shows that it is only a matter of getting e-

nough of poultry on the job to make Mr. Wevil scarce. Under date of Jan. 6, 1917, Mr. W. L. McAtee of the Biological Survey writes, in essence, that when opportunity affords, the Bureau will be glad to make observations on the use of poultry in destroying boll wevils, although the work relating to domestic fowls pertains to the Bureau of Animal Industry. Youthus here see that, in common with every sane man, Mr. McAtee does not look at such use of poultry as impractical suggestions as the Entomologist claims his experts pronounce it to be. The adult alfalfa wevil is of about the same size as the boll wevil. As for the immature stages, poultry forced to stay in cotton fields will be mighty quick to pick on fallen squares and should be quick in learning to hunt for the one containing a juicy grub. The Bureau of Entomology had far the best means and biggest appropriations to test this out.

Since apple, pear, plum and cherry are the favorite food plants of the browntail moth, orchards are their favorite feeding ground. This problem of control is discussed more in detail along with that of the gipsy moth at the passages cited. The young caterpillars hatch after the middle of August and spend the winter in webs in the top branches of the trees. In the spring "if the infection is bad, the caterpillars are often numerous enough to devour the leaves as fast as the trees are able to develop them." (Farm Bul. No. 564, page 9.) Thus since poison then could not be used, the Bureau advocates a spraying of 6 to 10 pounds arsenate of lead to 100 gallons of water, applied by the middle of August to kill the young caterpillars soon after hatching, a course expensive and uncertain, because there is much variation in time of hatching, and objectionable of danger of poisoning fruit.

Of course a high power sprayer is required, The young caterpillar, if not killed then, will do but little damage that fall, and an excellent way of control would be to go over the orchard after the most of the leaves have fallen, say after the middle of October, with a torch outfit constructed after the principle of the towersprayer outfit, as described on pages 11 to 13 of my Circular No. 147. Selecting a warm spell the caterpillars will be ac-

ive and drop off upon feeling the heat. This would not kill them, at least not at once, but poultry might be kept handy to pick them up. They are then only about one-half inch long. Besides in the absence of poultry, the ground can be licked where they fall, thus killing them.

This use of the torch makes for the cheapest insect killing agent known, where chemicals cannot readily be used. Also the flame destroys the spores of fungi. This was conceded as far back as 13 year ago by the State Entomologist of Illinois, a matter discussed at some length on pages 10 and 12 of my Circular No. 148. Every one connected with agriculture in the Eastern States knows of the damage done by fungi. During hot moist weather in summer, a licking with a torch is extremely swift and cheap, and works in wet weather, while spraying does not.

A torch outfit of the tower type, it is shown on page 9 to 13 of my Circular No. 147, is far the best means of controlling the insect, admittedly extremely injurious, now getting a good foothold in the East. As there explained all you have to do is apply a mild licking with the flame while the insect is in the larval stage, when upon feeling the heat they will drop, when they can be killed through more heat applied to the ground. The Bureau has nothing at all that can approach this in cheapness and efficiency.

As near as I ever could learn, I was the first to apply heat from a torch for the destruction of insects. I did this first in the late summer of 1896, with a view of trying to get rid of harlequin cabbage bugs. The following year this was kept up on insects in general, and it was incidentally found, that the adult harlequin bugs would fly to tassels of sweet-corn, where they could be more easily secured. I suggested to the Secretary of Agriculture in 1898. after publishing what I had found, that this and other original knowledge I had published be acquired for the public benefit. He said the government never had done anything of this kind. Bad as this was the Entomologist now goes him one better and claims I am wrong all around, Taking this harlequin bug for example, the country must sustain needless heavy loss. In my Circular No. 141 I had pointed out that better

trap-plants for this insect could be secured by seeing to it to have always some coneiferous plant going to seed, as then the bugs would congregate on the seed stalks. Again, on page 24 of my Circular No. 147 it was further shown that poultry given access to these trap plants would pick off the adults, and thus the whole matter of disposing of these highly troublesome pests can be made to almost take care of itself. This insect is highly injurious in the Southern States. Thus the New Mexico Experiment Station in one of their latest reports states that this insect ranks first as a truck-crop pest in that state, The Entomologist has nothing that is practicable.

Another highly injurious sucking insect for the control of which the Entomologist and his boasted experts have no practical means of control is the Mexican Conchuela, referred to in various places in my Circulars No. 147 to 150, and discussed in detail in my Circular No. 140, pages 1 to 15. This insect feeds on almost anything, but prefers fruits and seeds.

Poultry in quantity will keep them in check on alfalfa or other early lowgrowing crops, and by seeing to it that suitable trap-crops Milo-maize for instance, to concentrate them on, are supplied later, and have them picked off there by poultry, such crops as peaches or grapes can largely be kept free.

This application of heat is also far the best means of control for insects hiding in the ground or about a plant during the night and cool part of the day, of which class the hop flea beetle and the chinch bug are good examples, They are discussed at length in previous Circulars.

If the loss to Texas by the boll weevil is 27 million dollars a year, it is about 75 million for all of the infested area. My plan saves this whole loss since under it poultry will keep this and other pests in check, so that the plant will be able to set all the fruit it can possibly mature. Taking all the evidence submitted by me, it is worth in insect-and fungus control over half a billion dollars a year.

Representative Hawley upon getting his second batch of lies was asked to see to it that the Entomologist be forced to

meet the issue. He did not secure any further reply. In common with all the other members of Congress I had tried before, with one exception, he did not want to express himself in any way as to whether or not the evidence submitted is sound, just as if he, in common with the rest, had no brains at all, and were not expected to have any and to use them.

The exception in the case is the representative of the 2nd California District, Hon. John E. Raker, to whom reference is made on page 12 of my Circular No. 148. Upon the issuance of my Circular No. 147 his attention was called to this matter, because Senator Gore had flatly refuse to do his duty, and he declared himself ready to see to it that it be carried through for whatever merit it might possess for the benefit of the public. In common with everybody else, including the Entomologist, he was unable to point out anything that was not sound reasoning.

When my Circular No. 148 appeared in March 1916, he suggested, since Senator Gore and Representative Lever had taken no action, that I take the matter up with Senator Morris Sheppard, he being chairman of the Committee on Expenditures in the Department of Agriculture. This was done and the matter was brought to the attention of many other members of Congress, which caused Mr. Raker to remark that this should bring results. The results wanted were, that the Entomologist be forced to either admit that I am right, or show wherein I am wrong. Well, it did not bring any such results. Upon the issuance of my Circular No. 149 Senator Sheppard was again kept posted and he asked the Department of Agriculture for an explanation. The result was that under date of August 15 he wrote me he had been advised my plans are not practicable, and that therefore he did not desire to push the matter further. He never gave me a look at what advise he got. Thus, he wanted to hang me without a chance of defense.

Meanwhile Mr. Raker was kept posted, and upon getting a copy of my Circular No. 150, he wrote, "Keep up your work and results are bound to follow." This was not saying much, but was saying more than all the rest of the Congressmen I had tried

before, put together. He, being unable to see anything but sound evidence, simply wanted me to see it through, believing this to be best for the public weal.

The evidence submitted shows that the Entomologist is humbugging the people with their own good money. That, therefore, there is not a Congressman whose constituents are not affected, and that, therefore, all members of Congress are in duty bound to have the matter sifted to the bottom.

Mr. Raker having expressed a willingness to co-operate with Mr. Hawley to the extent of getting the U. S. Entomologist to define his position, he was asked, while this Circular was being prepared, to use his influence to get the Entomologist to act. As a result I receive on March 17th a copy of the reply Mr. Raker had received from the Department of Agriculture. It simply was a bundle of lies. However, unlike all previous statements it contained specific statements which were expected to be taken for proof by Mr. Raker that I am wrong. These statements, all short, refer to the control of the range caterpillar, the boll weevil and the Argentine ant.

In the case of the range caterpillar the Department claims that my plan of control consists in "that turkeys be secured in sufficient numbers to destroy the insect. It has been shown however, that on account of the poisonous hairs born by the caterpillar. turkeys will not feed upon it." This when it had been pointed out to the Bureau from the beginning, nearly two years ago, that the period when the caterpillar has poisonous hairs is the most unfavorable time to attack it, that the insect is within the reach of poultry the whole year around, and that the correct time for attack is while it is present as egg, as young larva, as pupæ and as adult, as explained in detail on pages 1 to 4 of my Circular No. 150, and also in this Circular.

As the adults deposit their eggs on stems of wild grasses or on weeds, the resulting caterpillars, no matter how plentiful, find enough food for partial development on the range, but as they run short, they attack, as far as accessible, cultivated grasses and grains. It would be quit impossible to protect these crops

by poisoning, since the caterpillar, being of the class of the tussock moth, the gipsy moth and the browntail moth, or well known to be extremely resistant to poisons once they are about one-third grown, hence coming as they do in hordes, they would usually eat up the crop first before the poison could have any possible effect. Hence with the Bureau silent on this point all along, the only possible means of protecting cultivated crops consists in keeping them down to harmless numbers on the range.

The Bureau's only proposed plan of control consists in, relying on artificial introduction of parasites and of predatory beetles. This is also the course that has been followed for the control of the gipsy moth in woodlands. But the Bureau frankly admits that these parasites may in turn be decimated at any time by hyper-parasites preying upon them, and for this reason the Bureau pointed out that a surer means of avoiding damage consists in changing the easily injured deciduous woodlands to less easily injured coniferous tracts; a proposition that holds out no chance of financial success.

In regard to the possibility of growing grain for poultry in the range caterpillar belt. Mr. H. N. Vinall, of the Bureau of Plant Industry was sounded for an opinion. He said in substance that while rainfall is light even for sorghums it is possible to grow fair crops of Dwarf milo and feterita. For details see Farmers' Bulletin No. 322, and Circular No. 122C.

In regard to my plan for controlling the boll weevil the Department says: "Mr. Reinlein's suggestion is that chickens be provided in sufficient numbers to destroy all or most of the weevils as soon as they make their way into the fields."

On page 7 of my Circular No. 150 you find explained why I had previously claimed that, by giving poultry, raised in sufficient quantities to do the work, the run about the fields during the period of emergence this "would certainly result in material reduction at small cost." Ask the Department what they have to attack the weevil with at this period. They have nothing. They deliberately want to convey the inference that it would be quite impracticable to have poultry in sufficient quantity handy, be-

cause, there being no use for it at other times, it would be impossible to have them ready during the period of emergence. They deliberately keep silent on the evidence shown on pages 8 to 10 of my Circular No. 150, which describes in detail the feasibility of the use of poultry practically the year around, not only for the control of the boll weevil, but also of the boll worm, the cotton caterpillar and several other important cotton insects. They also want to convey the inference that there would not also be plenty of work for poultry on other crops, thus making it possible to economically sustain large flocks the year around.

As explained on page 8 the Bureau's plan of plowing out the plants in the fall, impracticable as it is on the whole, or the cutting off of the plants, forces the weevil to hunt for food, and, finding none, causes it to adapt itself to feed and breed upon plants other than cotton. As shown there, it is manifest that if this habit is allowed to become fixed, control by the destruction of the cotton plants in the fall, what there is of it now, will lose its value, and control will be made indefinitely more difficult. To counteract this tendency, I showed there, as also in this Circular that the best thing that can be done, is to provide trap patches of very late planted cotton. The Department wants to keep quiet on this point, also wants to keep silent on how these trap patches incidentally make possible the complete control of the boll worm. Nor do they want to admit that poultry would pick on the fallen infested squares and destroy the grubs within, keeping up this work through all of the fruit setting season.

This habit of poultry of picking on fallen infested fruit I had shown can be taken advantage of in many other cases. Since the Bureau wants to keep silent I wish to point out that this habit is of very great value in the control of fruitflies, such as the apple-maggot or the Mediterranean fruit-fly, (Ent. Cir. No. 160) because, it will be shown, this course is the only really feasible means of control.

Admittedly, for this group of insects, "no very successful means of control have been found." The Mediterranean fruit-fly

has not yet invaded this country, so far as known, but it is in Hawaii, found there in 1910: and in Bermuda, supposed to be there for about 50 years. Hence, since it infests practically every kind of fruit, including the tomato, egg-plant, string bean, prickly-pear and pumkin, may have been brought into this country years ago, but by having plenty of chance to diffuse and by being similar in its work to the apple-maggot, may not yet have been noticed.

Because of the great range of food plants, wild and cultivated, little good can be expected from the collection and destruction of fallen infested fruit. As a result "in regions where the pest is well established, as in Australia and South Africa, much attention has been given to devising effective remedies, other than the collection and destruction of fallen fruit. A plan ... was the covering of the trees with netting and ... was thought to be practical. ... This plan apparently has not been followed to any great extent."

The only other known means that has any chance of success is the more recent use in South Africa of a poisoned bait sprayed over the trees for the destruction of the adult flies, evolved by Mr. C. W. Mally (Ent. Cir. No. 160, page 18). The results were surprisingly good. To get these results, however, it was necessary that the bait was evenly distributed over the trees, prickly pears, bush, etc., around the orchard.... Practically all the flies present during any one day found it very quickly and fed on it to their destruction..." (p. 19) 14 applications were thus made and the cost for material was about 8c per tree. What it cost with the labor added is wisely left out. Again, rains might interfere, and the application of the spray to fruit as it is approaching maturity might prove objectionable." Nothing is said as to what effect such continued poisoning would have on other insects, beneficial or neutral.

"...When (the larva are) fully developed, which usually requires a fortnight or three weeks, they leave the fruit, which has as a rule fallen several days previously, and enter the ground, seldom going deeper than one inch, depending on the nature of the soil. There they soon change to pupæia and remain for 12

days to three weeks, depending on the season....(p. 13).. Pupæ were present under some of the decaying peaches.,..(p. 18).

Thus poultry going about cultivated or wild vegetation infested, would simply have to pick on fallen fruit and thus either find larva within, or would, upon turning the fruit, often find pupæ in full view, while those not feasible will be found by scratching, usually within an inch of that very point, Hence, economical control of this insect, or of the apple maggot, clearly calls for the widest possible use of poultry; this is simply making a systematic use of a domesticated kind of natural enemy. "It (the Mediterranean fruit fly) is without question the most destructive fruit pest on record in the world today." [p. 10]

"The Argentine Ant," the Department tells Mr. Raker, "is an insect which makes its nest in buildings.... Mr. Reinlein's plan is to use a plumber's torch to drive the ants, which he believes will carry their eggs and larva with them, into the open where it will be devoured by poultry."

Every word is a lie.

In Entomology Bulletin No. 122 you read: "At all the infested points the levee is found to be teeming with the ants and the batture itself is a constant breeding place... Here the ant colonies are found under every particle of driftwood and trash and during almost the entire year they are in attendance upon Coccidæ and Aphididæ upon the willows." Ask the Department what means they have to control the pest there or on crops. whereby attending lice and scale insects they make, it is estimated by the Department, on the average 5 specimens grow where, in their absence, one formerly was found before.

The Department has nothing, absolutely nothing that is at all feasible. Just the same they want to deliberately fool the public by refusing to even admit that poultry raised in a systematic way to cope with such an enormous proposition has a chance to be of any value. This when they, in Bulletin No. 122 state that the ants, when unmolested, very greatly interfere in the raising of chicks, from which it follows that poultry is by nature an enemy of this pest.

In summer time the ants appear to do as little excavating as possible and seem to limit their efforts to excluding light and water, etc. [E. B. No. 122, p. 56.] In case of danger the workers' first instinct appears to be to remove the young [egg, larva, pupæ] to a place of safety, and they readily sacrifice their own lives in order to accomplish this. [p. 40] Thus poultry, given a chance, will simply scratch the whole combination up and eat them up. For a beginning, however, to get a flock established at this work in a badly infested locality, I had pointed out that it might be of benefit to assist them some. One way would consist in accelerating their destruction by the use of a blast torch, the kind shown on last page being a good type, and another way would consist in exposing quick acting poisoned sweets to the ants, which latter kills a limited number and drives the rest away from that particular place, giving poultry an undisturbed roosting place at night.

It is manifest that there is much wild land that needs clearing, and a man wishing to rear poultry there should be welcomed by any owner to do so, and this would result in a self-sustaining well paying business, but if this work could not be made to pay for itself, it would have to be done just the same, since there is no more feasible way known, and since without it the ants would be masters of the land, and stay masters.

On page 11 of my Circular No. 150 I made reference to Agriculture Bulletin No. 377, giving the results of poison experiments to control the ants in houses. I showed on pages 11 to 14 that the most feasible means to obtain this consists in first of all giving the widest possible use to poultry outside, and then control the ants that have gone to nest in the houses by exposing quick acting poisons, which kills a few and drives the rest away quickly, stating expressly on page 13 that, "the use of poisoned sweets for control in houses is a necessity." No talk about any torch at all. You probably did not look for any such skillful lying on the part of any Executive Department.

"The experts of the Department are of the opinion that Mr. Reinlein's plans are entirely impracticable....", the Department

winds up its yarn. Then just let them point out what plans described in this circular are impracticable.

The Bureau makes no attempt to point out any means of controlling any invasion of cultivated crops by the range caterpillar. There are no means that can be pointed out. Neither they nor anyone else has any, except it be continued hand picking. How entirely futile the use of arsenicals would be can be gathered from a record of an outbreak of the yellow-bear caterpillar given in Entomology Bulletin No. 82, part V. "Judging from the results of these experiments, the arsenicals [applied to larva one-fourth to three-fourths grown, whereas the range caterpillar invades the crop when nearly full grown, and is much larger] cannot be depended on to control." [p. 66] "On reaching maturity the larva crawl under heaps of dead weeds, tufts of grass.... In such quarters, which offer but slight protection they construct frail cocoons.... There is no better method of fighting this species than to burn the weeds, grass etc., under which the pupæ, [of the hibernating brood,] find protection...."

But there is a better way: Poultry given the run through such weeds, grass etc., will be able to get many of these pupæ. Besides there is also a Spring brood with insects in the pupal stage during summer even still lighter protected. This course of control I had shown in previous circulars to be applicable in many other cases; especially in the control of certain timber insects.

Whatever would burn is intended by nature to serve as protection for the plants and for the animal life subsisting under their protection, for providing breeding ground for ground dwelling birds, for increasing humus, retaining moisture, preventing erosion. Hence, such burning, often recommended by the Bureau in similar cases, cannot be too strongly condemned.

Details for meeting the conditions that will be encountered in carrying on poultry raising on a large scale in the range caterpillar territory are given in my Circular No. 146, pp. 9 to 14. I may add that, since the succulent plants in that area are usually protected by strong spines, hence are not available for food, it is feasible, where they are available, to render daily a small

patch of them fit for nourishment, since they then provide both food and drink. This can be done through the use of a cactus burner or a hot air blast torch. A suitable type is shown on the last page of this Circular. A little grain scattered through that patch will attract all of the poultry to that spot. A supply of feed can as readily be provided on the range as anywhere, through the raising, in suitable valleys, of grains adapted to semi-arid areas. It is also practical to raise green feed for winter feeding, since at least the necessary breeding stock has to be carried over, by the raising of root crops, hardy and not hardy, and of vegetable plants, hardy in that territory, such as kale and Brussel sprouts.

It is true that on page 12 of Bulletin No. 443 the Bureau claims cultivated cereal crops can be protected against the range caterpillar by spraying with a solution of one pound of powdered arsenate of lead to 50 gallons of water. But where are the tests to prove such an idiotic claim? The Bureau has found it necessary to recommend the use of 3 to 5 pounds of arsenate of lead to 50 gallons of water for the destruction of newly hatched larva of the browntail moth, then what can you expect from a third and fifth strength solution of this where "the full grown larva frequently measures $2\frac{1}{2}$ inches in length, with the diameter of a man's index finger," (Bull. No. 85, p. 78) and where there is a continual stream coming in from the surrounding range?

All the essential features of this, and much other matter besides, was explained to Mr. Raker by the use of marked and annotated copies of my Circulars No. 146 to 150, and Mr. Raker was asked to hand this up to the Department for action, after having examined same. This he did, and he got the following reply: "The experts of this Department are of the opinion that Mr. Reinlein's plans are impractical. Apparently he is writing theoretically and without any first-hand knowledge of the insect concerned."

Thus seeing that Mr. Raker was giving me a chance at making a defense, they did not want to make any specific statement this time, and did expect Mr. Raker to let the matter rest upon their word that I am wrong, this when they had been asked

to show why their previous letter had not been a bundle of lies. Naturally Mr. Raker was asked, under date of April 13th, to prosecute the matter further.

The far-reaching evils of erosion, their cause, their effect and their prevention, are described in Yearbook Separate No. 688, Farms, Forests, and Erosion. "In general anything that increases surface run-off, increases erosion... As a rule it is only when the natural protective cover of forests, brush, grass and other plants is disturbed that serious and long continued erosion results" (page 8)

This is all new to the U. S. Entomologist and his experts, judging by what they write. A good sample of what they write appeared recently in Agricultural Bulletin No. 416; The Red Spider on Cotton. Under heading of Remedial Measures, you read on page 60: "Too much emphasis cannot be placed on the importance of ridding all field borders, ditch banks, terraces, etc. of all vegetation as far as possible...."

Since cotton is only one of the 183 kinds of plants the red spider is known to feed on, employing this means in this and in other cases as advocated by the Bureau, for instance in the destruction of hibernating quarters for the chinch bug and the boll weevil, would, a perusal of Separate No. 688 will convince you, in the course of a comparative short time, turn the country into a desert.

But aside from this I had shown throughout my Circulars No. 139 to 150 that such destruction of host plants is all wrong, and that the correct way of control consists in using the preferred host-plants for traps if they are to be used at all as a means of control. Since the Entomologist has been talking for about a year to the effect that I am wrong all around, without offering a particle of proof, I now prove them to be wrong once more, from the latest available evidence.

On page 59 the authors state that the red spiders hibernate on several of the native and door-yard plants. "These hosts serve as sources of dispersion." Of course, what else could they do if not treated. "By destroying during winter and early spring

polkweed, Jerusalem oak, Jamestown weed, wild blackberry, wild geranium and other plants which breed the pest, much good will be done. This plan has been tested by the writer in several instances and has given complete immunity the following season..." How these plants were destroyed is not stated, probably by burning and grubbing out. How about the next season? Has that work to be done over again every season? Of course with first choice food plants removed, the spiders will subsist on second, third and last choice plants. True, there is no practical way to treat the plants, especially in out of the way places, except by the way shown by me as far back as 1898, by using the hot air blast, for which work the type of torch shown on last page is very suitable. These weeds are very often not on the owners land and, anyway, if on waste places; should be left there except to give something better a chance, which in turn, will also harbor spiders,

"...In several instances of past severe annual infestation, violets" (probably the most favored winter food plant) "adjoining fields have been thoroughly sprayed, with the result that no red spider appeared in these fields..." Therefore you see if you only did treat these plants, they would act as traps instead of sources of dispersion. And hot air furnished by a torch is extremely cheap. Then again, since these plants may not be on the owners land, he can keep his crop clean by giving the plants near the source of infestation an occasional slight licking with a torch.

With a practical means of controlling them on the crop at hand, there is some very good reason why the winter host plants should be left to themselves. Anything that kills the spiders kills also, as a rule, the natural enemies that are present. If the host plants are not treated, they usually become heavily infested and in turn much sought after by natural enemies of the spider, causing the latter to increase in number. As the spider does not spread fast the use of a torch near the edge of the field makes it possible to absolutely control invasion.

Again, taking cotton for a sample, this crop is attacked by many other enemies. Suppose infestation by red spider had

been prevented through destruction of host plants, but the cotton aphid were taking a hold. Repeated slight swift lickings with a torch are far the best and cheapest means of control for this insect, and for aphid in general. On the other hand if nothing was done and red spider is invading the crop, the spider is thus being taken care of without extra work.

In thus using a torch other larger insects present will be noticed, because they start to run when they feel the heat from the torch, when they can be killed. A large part of these would require hand picking or expensive contact insecticides. However, as will be shown later in discussing boll weevil control, poultry can be made to take care of these.

It has been suggested to Mr. Raker that the matter had reached a stage when it would be specially opportune to have him call the attention of Mr. Lever, Chairman of the House Committee on Agriculture, to it. As a result a letter was received from him May 8, containing the following: ... "It is my purpose to work with Mr. Raker or any other member of Congress that can and will give their assistance to this matter. The Department claims there is nothing in your idea, that you are wrong on all points."

Thus Mr. Raker himself has found no evidence that I am wrong. On the contrary wants to be shown if there is anything wrong about it. As for assistance, Mr. Lever is bound under the law to make the Department meet the issues. admit that I am right or else show what is wrong.

That poultry raising as a means of controlling certain insects can be made to pay, and pay big, is pretty conclusively proven by evidence presented in Year-book Separate No. 700: The Thanksgiving Turkey. There on page 4 you find an account of successful turkey-ranching carried on "in the unsettled foot-hill region of California, and in certain sections of Arizona and other western states." If turkey can thus be profitably raised on a large scale in semi-arid, mountainous and very thinly settled sections, it is not clear why there should be any barrier to the systematic raising of chickens for both meat and eggs in the region infested by the range caterpillar, or elsewhere over low-

priced land, for that matter.

Beginning with the melting of the snow after mid-winter, with insects then as yet completely inactive, and wild seeds scarce or absent, stems of grasses or weeds carrying the prominent egg-clusters of the hemilenca become the object of favorite attack by poultry. The insect is exposed to attack in this form as a rule, till June 1st.

The larval period in the largest number of cases extends from June 1st to September 1st—three months. That the poultry would effectively attack the insect in the larval form is proven in Ent. Bull. No. 85, p. 93: "On July 27, 1909 two robins were seen, each with a hemilenca larva in its bill.... By this date the majority of the larva are half grown. The birds flew away with these...—apparently only of the smaller ones—as if intending to feed the caterpillars to their young." Thus if young birds can stand such young larva, it is safe to say that poultry can eat great numbers of the newly hatched and partly grown ones. And of course it is all a matter of the number of poultry on the job, whether any young larva would be left to grow big. There is nothing objectionable about the pupæ. Skunks eat them greedily, although according to Chief Nelson of the Bureau of Biological Survey there is at present no evidence to show that they eat of the larva, big or small. The adults are in plain view, resting on stems of grasses during the day, hence subject to attack. Egg-laying begins early in September, the species in this stage thus being subject to attack from then on till covered by snow.

All this, with much other matter, was in essence pointed out in my Circular No. 146, August 10, 1915. As the Entomologist has done nothing to satisfy himself as to the value of the evidence submitted, it will be well to see what he says about birds, as enemies of the gipsy- and brown-tail moth. The latter of the two seems to be the worst of all important hairy caterpillars as regards the nature of the hairs.... The presence of caterpillars of the brown-tail moth in large numbers was actually unbearable on account of the poisoning... (Yearbook Separate No. 706, p. 2) Birds have some importance as enemies of the gipsy-moth...

pothunters...have destroyed great numbers of insectivorous birds. "Much of the increase in the number of the pest is attributed to this." The caterpillars are preyed upon by the cuckoos, the Baltimore oriole, the yellow-throated vireo and the blue jay." No distinction is here made between big and small caterpillars. "The moths are eaten by many birds," which is pretty good evidence that poultry would eat the moths of the range caterpillar, "and the eggs are eaten by several species." (Farm Bull. No. 275, page 15.) Again, "birds are important in checking the spread of the brown-tail moth. The caterpillar, like other hairy species, are not so much eaten by birds, except certain ones..... The moths...are preyed upon to a great extent by birds...." (Farm. Bull. No. 264, p. 18.)

In regard to controlling such insects by means of natural enemies, the Entomologist says in Year-book Separate No. 704, page 9: "...with other kinds,...which may exist in the egg stage, in a crawling larval stage, in a quiescent pupæ stage, and as a flying adult, and which in their native homes are parasitized by whole series of species of parasites, some attacking them in one stage and some in another, and still others in a third, it is not such a simple thing to introduce and acclimatize the parasites necessary to reconstitute the normal environment." And admittedly these parasites are subject at any time to decimation by hyper-parasites.

Since the gipsy- and brown-tail moth are principally tree-feeding insects, they are usually out of reach of poultry. But they are also often within reach. ... "It is a common habit with the larva (of the gipsy-moth) if they are disturbed, to spin silken threads which are attached to the trees, and in this way lower themselves to the ground." (Yearbook Separate 706, page 5) Thus if a larva lowers itself a few times with poultry on the ground, the lowering is apt to be stopped for good. "...Of course the brown-tail moth is carried in the caterpillar stage just as is the gipsy moth" (through their lowering on silken threads) "upon vehicles of different kind passing through the infested region and upon the persons of pedestrians as well,...(Farm Bull. 264, p. 13) "...small caterpillars [of the gipsy moth] immedi-

ately after hatching may be blown long distances by the wind. It has been proved that spread often occurs from a distance of from 12 to 20 miles in this way. [Y-Sepr. 706, page 5]. How to get rid of such scattered caterpillars the Bureau has not the slightest suggestion to offer. With the woods patrolled by poultry for this and other pests, such as the brown-tail moth and the tussock-moth, this would keep the incipient pest in check. There is no means of extermination. The gipsy moth has been discovered as far west as Cleveland, O. Being an isolated case, everything humanely possible has been and is being done to stamp out the pest. But with young caterpillars having been blown 12 to 20 miles it cannot be told for years with any degree of certainty whether the attempts at extermination have been successful.

"Over half a million dollars is the yearly expenditure [for the control of the gipsy moth] in Massachusetts at the present time." [Y. S. No. 706, p 8,] This is for work by towns and cities. In the woodlands the gipsy moth multiplies unhindered. It will be seen then, that unless the moth there is kept in check—and poultry is the only means in sight, the Bureau having nothing to offer but parasites and elimination of favorable food plants, such as oak—with the young capable of being blown for miles, there will be a constant reinfestation of cleared areas from this cause alone. This alone explains why "it is inevitable that new colonies will be found from time to time outside the region now known to be invested,.." Thus in Dep. Agr. Bulletin No. 273, p. 18 it is estimated that the wind blows 210 million small larva annually into the ocean, and the number is probably much greater. It also emphasizes the necessity of keeping this moth confined to New England territory if rapid and general spread over the United States is to be prevented."

In Year-book Separate No. 704, p. 14, the U. S. Entomologist says: "On the whole, the work [of importing parasites of the gipsy- and brown-tail moth] has been very successful, and has helped in bringing about infinitely better conditions in New England so far as these pests are concerned, and while it is practically certain that both the gipsy moth and brown-tail moth will

gradually spread westward, it is equally sure that the imported natural enemies will go with them, and that none of the long continued disastrous outbreaks which we saw in Massachusetts in the years prior to 1905 will occur further west."

Let us see: "...A large part of the funds expended by towns and cities (in Massachusetts over half a million dollars a year) has been used for the protection of shade and ornamental trees, it having been found impossible to carry on extensive work in woodlands, owing to the extreme cost of these operations. The beauty and attractiveness of most cities and residential sections depend on the trees..." (Y. S. No. 706 p. 10) That means that no funds were spent in woodlands except a little for experimental work to find out that such work as is done in cities and residential sections involves their "extreme cost." The fact is the woodlands are not accessible to spraying machinery, and moreover represent far too low a valuation for this and all other artificial means of control, hence the insect there is left to breed unchecked. The "long continued disastrous outbreaks" have been and are existing there right along. "Enough pressure was brought to bear, however, in the fall of 1899, to cause the discontinuance of State appropriations for the control of these insects...Matters became so serious in 1905 that work was resumed by the Commonwealth of Massachusetts..." Thus you see the "disastrous outbreaks" this humbugologist speaks about referred to conditions in towns and cities during a period when the state spent no money for 5 years.

The "infinitely better conditions" thus leaves the country at large without control, and as for work of the parasites, the insect does sufficiently well in spite of those to require the use of half a million dollars in towns and cities in Massachusetts alone. Poultry is a natural enemy of these and other insects, the only natural enemy that can be definitely controlled by man in its work, hence should for control in woodlands and farms, form the chief reliance in control.

As for control in cities and residential sections this could be simplest secured through trapping the adults, in the case of the

gipsy moth of the male only. If woodlands and farms are controlled by poultry the number of brown-tail moths congregating in cities will correspondingly decrease, and thus greatly reduce the necessity for control there. If you will see to it that your Congressman uses his influence to see to it that action is taken on the matter in hand, I propose to show you how these moths can be trapped in vast numbers at surprisingly low cost. Until this is done you will have to look to the Secretary of Agriculture and his experts to show you how this trapping is done.

Mr. A. S. Weiant, the author of Year-book Separate No. 700 was asked to tell what he knows about poultry as a means of controlling insect pests. He said to do this one should be an entomologist. Speaking of turkeys as largely occupying his attention, Mr. Weiant says: "As a means of keeping down grasshoppers I can vouch for them." There is no good reason why chickens should not answer as well. If so, this then simply proves that I was right when I said as far back as in my Circular No. 147, p. 15, that the correct means to control grasshopper outbreaks consists in judiciously using poultry: that since their stronghold is in the high, dry, rocky lands, dangerous invasions from that source can be prevented by having large flocks of poultry roam over these otherwise nearly idle lands. Over further on Mr. Weiant says: "Turkeys are naturally great rangers and when given the opportunity can pick up the most of their food in meadows, grain fields, pastures, alfalfa fields, etc."

Then why not raise enough of them to utilize all of the existing opportunity? And why should chickens not do as well? I have noticed in the South that turkeys spend very little time in the cotton fields provided there are any pastures or grain fields to roam in. This is just what one would expect. Meadows, grainfields and woodlands offer far better feeding than cotton fields early in the season when poultry will be wanted to be kept in cotton fields on purpose as needed, the shortness of food supply forcing them to hunt for weevils and attack fallen infested squares, pick up Argentine ant workers to keep them from fostering aphid infestation, during which they render far more value in spite of requiring more grain and more attention, than they would by consuming food where it is more plentiful.

"An insect must become quite common before it can form an appreciable portion of the food of (wild) birds..." Bul. 107, page 2. If so, you cannot expect wild birds much to reduce the boll weevil, since being multi-brooded, reduction in number of hibernated adults is what is most needed, and a small number is admittedly easily able to produce an off-spring large enough to destroy the crop.

"The natural food of the turkey consists of insects, green vegetation, seeds and nuts of various kinds." On page 4 of Year-book Separate No. 700 Mr. Weiant points out that turkeys greatly relish acorns and that where these are plentiful but little grain need be used for fattening them in the fall, which fits in nicely with turkey raising in the woodlands of New England, consisting as they do largely of oak, as a means of keeping down gipsy- and brown-tail moth infestation. "Of the insects turkeys seem to prefer grass-hoppers to all others, but they will also eat circkets, grubs and worms of various kinds, flies, butter-flies, moth, etc." There is no reason why they should not eat of the hemilenca moth (range caterpillar). These being on the grass-stems in plain view, simply waiting to be picked. As at that time, late fall, there are hardly any grass-hoppers, they represent the food most easily available. "Some insects they appear to let strictly alone. For example I have never seen a turkey eat an ant. a caterpillar, or a potato bug." Now ants may be too small, besides they might eat them in the form of larva and pupa, if not as adults. As to caterpillars, if fully grown hairy ones are meant by this, it is correct enough. How about the small and spineless ones? Only careful tests can tell.

As to what birds do in the way of destroying the Argentine ant you read on page 73, Ent. Bull. No. 122: "On one occasion Mr. G. A. Runner observed an English sparrow industriously picking up the Argentine workers from a trail which crossed a wide roadway at Baton Rouge. This habit is not, however, a common one with this bird." If this sparrow could get at nothing else, a condition that can be imposed on poultry, the habit would become common at once.

"The flicker, or yellowhammer, *Calaptes auratus*, has of-

ten been seen industriously digging up shallow ant nests in lawns and grass plots, evidently for the purpose of obtaining the pupa and larva, and should doubtless be credited with being the most important natural enemy which this ant has in the South.,." What the Entomologist was wanted to show all along was why poultry would not also dig up these nests.

Speaking of poultry catching moths, it should be borne in mind that the adults of some borers most difficult to control are moths.

Take the sugar cane moth borer. This insect is, in Entomology Circular No. 139, p. 2, conceded to do enormous damage. Figures there given place the loss on plant cane alone used in one factory in three years previous to 1912 at \$145,445.

Since the U. S. Bureau of Entomology has published very little in regard to the life history of this insect, I asked Governor Pleasant of Louisiana for the favor to request his State Experiment Station to send me a copy of their Bulletin No. 70, second series: The Cane Borer. This was done. The remedies there given consist in substance in planting the cane as near as possible in the fall, burning all trash, and of culling cane and corn in the spring. The borers in the buried fall-planted cane are not able to emerge as adults through anything as thick as one-half inch of loose soil. "The windrowed areas should be systematically gleaned after removal of cane for spring planting and all pieces of cane destroyed by fire or carefully buried..." [p. 923] "all trash [cane tops] should when cut be so arranged upon the cane rows as to hasten drying and whenever dry should be fired...." (p. 924) The borer's "only food in Louisiana has been found to be sugar cane, corn, Johnson grass, Guinea corn, sorghum, (sweet and sour-sweet) and possibly two other large grasses." (page 927.)

But to burn or bury all waste is a pretty big job; besides burning any kind of vegetation means a loss. The Department of Agriculture fathers the statement that "the burning of a wheat stubble deprives the land of as much fertility as the producing of five crops of wheat." If so the main loss is sustained through the action of the fire upon the soil.

"Everybody [with but few exceptions] burns the trash.... yet with this only known effort practiced alike in every community, the borer multiplies to a destructive extent in one section and is practically subdued in another." (p. 902)

Thus you see the need for something better, or at least for some effective additional means of control. "If fall planting only be made... the enclosed borers must remain until the cane is scraped in the spring and the few which will then escape would be hardly enough to produce much harm during the summer..." (page 904):

Let us see: On page 925 is given the record of a cane culling bee. 420 acres were culled in the early spring, filling 120 sacks, each having 333 borers, or a total of 39960, this makes a catch of 95, say 100 borers to the acre. A female lays on the average 300 eggs. Thus one female emerging from every 3 acres of scraped cane might do all this damage. Suppose 10 infested stalks per acre of first brood were missed. This gives us five resulting females, at 300 eggs each, or 1500 borer of second brood during say, June-July. 750 females will result, at 300 eggs each you have 225,000 borers of the third brood during August-September: and 3,375,000 per acre for the 4th brood during October-November. While such numbers do not occur, more likely because of cannibalism than of all other causes combined, it shows that the insect has the faculty to increase to such numbers as can subsist under such competition.

"Corn is more succulent, more rapid in development and thus in the economy of the borer assures the development of many more specimens than if cane were the only food plant of the first two broods..." (page 912). Infestation of young corn is shown to be about ten times heavier than cane. (p. 912)

Investigations have shown that 87 per cent of the moths emerge prior to April 15th. Moths come from the pupa cases at night and after expanding their wings remain hanging to some plant or other object during the entire following day. The second night mating takes place and a few eggs may be deposited.. The moths are not shy and unless vigorously disturbed will not take flight during the day..., (p. 910).

Since windrowed areas produce the largest number of moths, a stand of young corn there, with the moths hanging on the plants can be made to serve as a trap, since, the poultry given access: the moths can be largely secured. In the past the advice given was that "...limited tracts of corn badly infested with the borer in close proximity to cane should be completely destroyed to protect the cane crop from succeeding broods..." (p. 925.); now with poultry at work there is no need of reducing the acreage of corn, or abandoning corn for a year or more, as recorded on page 914 to have been found beneficial in preventing heavy infestation of cane.

"...few if any moths emerge during the colder months of winter... (p. 910) ...the moths while existing in small numbers confine their attacks to the ends of the rows and to the ditch bank rows..." [p. 903]. This either means that the earliest emerging adults have wintered outside of the fields hidden away under some heavy vegetation, or else it means that the insect has hibernated as larva on plants on the ditch bank and more adults have developed there early than did in the fields; or it means both. At any rate the thing to do is, instead of planting no corn, to plant corn by preference in the ditch bank rows and as near as possible at the ends of the rows, and to protect also the interior of the field by strips of corn, kept patrolled all through the season by poultry. It is obvious that there must be always corn on hand that is young. To this end two crops of corn are grown on these strips, some corn, beginning on March 1st, being planted at intervals of one month up to September 1st. While harvesting of cane is going on and before there is frost, the borer, with corn present, planted August 1st and September 1st, will virtually confine oviposition to these savings. These should be left standing. A legume can and should be sown between at the last cultivation. Stock may be admitted after frost and the whole thing must be plowed down nicely before the beginning of emergence, say before March 10th.

If poultry be not used, it will be readily seen that the normal requirement of corn could not be produced without endangering the cane crop unless a great deal of care is used culling

the corn. It would not seem feasible to cull millet by hand, hence under the old system millet must be left out of the crop rotation.

As practically all of the cane growing area is overrun by the Argentine ant, poultry is needed all through the summer to pick up the workers to prevent undue multiplication of the measly bug and of aphids. Besides there are numerous other insects affecting corn and cane, and other crops necessary to allow at least of some diversification, which poultry can be more or less successfully used to control.

Another highly injurious day-flying moth is the adult of the peach-tree borer, which deposits her eggs at the base of the trees. Poultry allowed to roam through the orchard with a view of keeping down insects in general, would secure a certain number of these, reducing the need for other means of control.

A day-flying moth that does very similar work, ovipositing at the base of the trees, is the sequoia pitch moth. It is at present the most destructive insect to the large pole pines in certain parts of Montana. Poultry made to roam the woods in sufficient quantity for controlling insects in general would increase the use of the land and to a certain extent keep this pest in check.

In his report for 1916 the Entomologist makes the claim that tests are being carried on by the Bureau of Entomology that hold out the possibility of a chance of discovering successful methods of preventing the establishment and spread of the pine-shoot moth, and of the European pine-saw fly, both "introduced shortly before the plant quarantine act became operative." [p. 16]. The first named insect has been introduced, as stated in Agr. Bull. No. 170, as far back as 1911, was found in 1914 in 20 localities in nine states, in one case, the work then being 3 years old. Both sexes are strong fliers, laying their eggs in the apical and other terminal buds of pine trees, thus offering not the slightest chance of extermination as explained in detail in my Circular No. 145 and 146. Yet even as late as this the Entomologist wants to humbug the people into believing that its establishment can yet be prevented, when for means of control it has nothing but the removal and burning of the infested shoots.

In the case of the European pine-saw fly, extermination is, if possible, even more broadly impossible. The adult is a fly. The eggs are laid in the needles on the tips of the trees. The insect was discovered in August 1914 in Connecticut. It has two broods, which means rapid dissemination. This insect, together with the larchworm, it was shown on pages 16 and 17 of my Circular No. 149, has been described rather minutely in the report of the Connecticut State Entomologist for 1915. Mr. S. A. Robicer of the Bureau of Entomology at Washington, is there quoted as saying that "...it has a large number of host trees" [in Europe] "and would no doubt adapt itself readily to the conditions in America....." [Rep. Conn. Ent. 1915, p. 119]. Thus extermination if attempted, would involve examination of pines and other conifers for many miles around the original infestation means of extermination there are none. As to means of control. "It is evident that *Diprion simile* is freely attacked here by American species of parasitic Hymenoptera and Diptera, but it is not known as yet whether any European species were brought into this country in the cocoons of the 'sawfly'". Other practical means, necessary when the parasites fail, the Entomologist has none. The use of poultry makes it possible to secure the larva as they spin down or fall down occasionally, or when they migrate over the ground to other trees. The larva being hairless should make choice eating for poultry. "In Europe raking up and destroying the leaves and other rubbish under the trees in the fall is recommended to destroy the cocoon." [p. 123]. A far better way would be to have the cocoons scratched up and eaten by poultry.

The larchsaw fly is single brooded, spends the winter in a cocoon beneath rubbish on the ground and thus can easily be controlled by poultry, besides the caterpillars are subject to attack when on the ground.

This insect "invariably chooses the young, green, terminal twig in which to insert the eggs.. When the apical terminal shoot is affected... a permanent kink may be caused... It is an injury which cannot be prevented..." page 127. Poultry, by keeping the insect down to limited numbers will prevent the in-

sect from laying any great number of eggs into any one shoot, and thus prevent any great injury to apical shoots.

This saw-fly "during several extensive outbreaks since 1880 has killed from 50 to 100 per cent of the mature larch over vast areas in the north-eastern United States and south-eastern Canada...aggregating many millions of feet." (Rep. Conn. p. 60) The chief factors in the control of the larch saw-fly are its natural enemies, which consist of birds, mammals, a large number of parasitic and predaceous insects, and a fungus disease." (Rep. Conn. Ent. p. 130). But since outbreaks do occur with this and many other insects of similar habits, why not use poultry when and where it is needed?

Since the Entomologist talks about half of his time about what great good parasites, native and imported, are doing as the result of the work of his Bureau, it is well to see what the pine shoot moth has done in Europe in spite of its parasites, and "in spite of continued preventative war against it.. If the attack is slight, it results in the branching of the tree," (since, if uninfected, the moth selects the apical bud for oviposition) "but if the attack is severe and continued for several years, as we have seen it, then hardly any bud is spared and the pines become stunted into miserable small bushes..." (Dept. of Agr. Bul. No. 170, p. 2.)

"It is reasonable to suppose that some of the native parasites on some of the native species of *Evetria* will in time also attack *Evetria buoliana* (the imported pine shoot moth) in this country—in fact parasitized larva have already been observed—but these native parasites cannot be relied upon to keep in check their natural hosts, the American pine shoot moths, which sporadically become very abundant and very injurious, in spite of the parasites and presumably will be less effective in controlling the newly introduced host." (p. 9.) "None of these native species (of pine shoot moths) can, however, even with this advantage [of having two broods annually] be compared in destructiveness to the European species just introduced..."[p. 8]

Since chiefly young trees are chosen for oviposition, I had shown in my Circular No. 145, page 7, that the sensible thing

to do is to protect, if possible, the apical bud in some way when the adults are about laying their eggs, the most feasible way appearing to me to be the pouring of some semi-liquid clay over the apical bud, causing thus the moths to oviposit on a side shoot, which serves just as well. I also described in my Circulars No. 145, 147 and 149, pages 13 to 15, how these moths and other night flying insects might be trapped.

Virtually all this and more was shown in my Circular No. 145, June 7, 1915, The Chairman of the Congressional Committees on Agriculture, Senator Thomas P. Gore and Representative Asbury F. Lever were urged to have the U. S. Entomologist either admit this to be correct, or else show why it should not be correct. Pouring semi-liquid clay over the apical bud either protects it or it does not protect it. "Early in August [in Europe) the eggs are laid singly on the new buds of the next years growth..." page 5. The adult will not of course, oviposit on hardened clay, when she has plenty of side shoots serving fully as well. The Chairmen mentioned therefore should have forced the Entomologist to define his position. And this applies to all issues involved.

Protecting the apical bud by an application of semi-liquid clay may be a simple enough idea. On the other hand this insect "has been the subject of much study and of an extensive literature from the time it was first described by Schiffermiller in 1776 to the present day." The U. S. Entomologist frankly says his Bureau is the best thing of the kind on earth. The fact remains, no one has pointed out this simple idea before; and now the Entomologist wants to pretend to be unable to see any good in it. And Messrs. Gore and Lever thus far, have wanted me to be hanged on that pretense.

The apparatus shown on last page was designed with a view to meet the needs for an apparatus, that will enable the man having a limited amount of vegetation, ranging in size from big trees down to grasses, to keep same free of insects and fungi. In a few cases, with the codling moth for instance, the proper use of arsnicals is the best thing at present known, but in the case of all sucking insects, and in any case where poison is

for one reason or another not satisfactory against biting insects, with the exception of where they can be controlled by poultry, or by trap crops, or by the torch used as a trap at night, the use of heat is far preferable to employing the contact insecticides now officially recommended.

It may be well to mention here that now flour mills and other buildings infested by insects are being fitted, as the best means known for control, with heating apparatus of such capacity that insects may be killed simply by giving so much heat that they will die purely because of high temperature, doing away with the many objections incident to using poisonous gases.

The use of heat from a torch, was first described by me in 1898 and was first used by me in 1896 as a means of controlling the harlequin cabbage bug. In his report for 1916 the Entomologist on page 18 says: "...Such remedies as trap-crop planting and the destruction of the bugs with special burners are among the most successful," in combating the harlequin bug. As for the trap crops, I had shown as far back as 1898 the adult bugs congregate on the tassels of sweet corn. More recently I have shown that by seeing to it to have at all times some cruciferous plant going to seed, the bugs will congregate on the seed-stalks and can be kept down by poultry, doing away with the use of heat, special or otherwise. But old or new, according to the Entomologist I am wrong either way.

The adult harlequin bug lays her eggs on the underside of the leaves of cruciferous plants, which leaves are mostly inverted spoonshaped; hence the young bugs usually cannot be seen without moving the leaf. Because of this the simplest means of control consists in concentrating the adults in plain view upon tassels of sweet corn or seedstalks of cruciferous plants. They then can be picked off by hand or by the use of poultry.

On page 19 of his report the Entomologist speaks about the control of the spinach aphid by lady beetles in the truck district of tidewater Virginia. He says "the extensive cutting down of trees and removal of underbrush for planting of truck crops left us available places for the ladybirds to hibernate..." Then how

does he expect these ladybirds to become and stay plentiful in the fields, since, moreover, they go to feed on lice on most of the crops and since all these crops need treatment as to insects and fungi, which treatment of necessity also kills the ladybugs. He says the plants cannot be reached, even with an underspray. I claim there is an "underspray" that reaches them, that is, reaches the lice hidden in the hollows of the inverted spoon-shaped leaves, especially when the plant is growing nicely in the spring. And this spray consists in the use of heat as applied by a torch. Some kind of knapsacktype torch is the thing to use and the essential feature in its use is to use it early, often, and swiftly, letting the heat blow slantways upon the ground a few inches from the plants as they are approached. The heat waves will then roll in between the leaves.

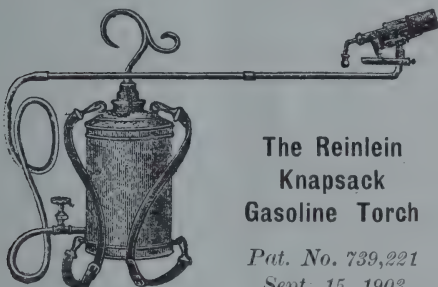
Without thus controlling the aphids, on the spinach, this crop will act as a winter host on a large scale for this and various other kinds of aphids, resulting in abnormally heavy infestation of succeeding crops.

The special features of the apparatus shown consists in that the handle of the pistonrod of the pump located in the center serves also as a hook, making it possible, after removing the shoulderstrap, to hook the apparatus from branch to branch in a tree. This does very well with the man having but few trees, making him independent in his work, since the official recommendations call for something else in many different cases.

For big trees in large numbers I have described on pages 11 to 13 of my Circular No. 147 how suitable apparatus furnishing heat can be gotten up. Heat thus applied is far the best means to destroy the stem mothers of aphids and the adult pearthrips as they congregate upon the bursting buds of fruit trees and fruit bushes.

I had also shown how apparatus applying heat to lowgrowing vegetation, such as oats infested with the spring grain aphid, can be constructed, using, if desired, as far as practicable fittings from the outfit used for orchard work.

The spring grain aphid is usually held in check by natural enemies—for details see Ent. Circular No. 93, Revised. The natural enemies rather often fail. The latest occurrence was right in 1916, as recorded on page 12 of the report. On pages 12 and 13 of my circular No. 144 I had shown at some length that the Entomologist has no tangible means of control. The use of heat does destroy the pest and should come into effect as soon as the danger of an outbreak becomes apparent.



**The Reinlein
Knapsack
Gasoline Torch**

*Pat. No. 739,221
Sept. 15, 1903*



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MAY 20 1918

THE CONTROL OF THE BOLL WEEVIL

By Fred Reinlein

PORTLAND, OREGON

Circular No. 152.

July 12, 1918.

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The Control of the Bollweevil

Copyright, 1918. By FRED REINLEIN, Portland, Ore.

Circular No. 152.

February 4, 1918

Revised

The Bureau of Entomology, in getting out Farmers' Bulletin No. 848 in August, 1917, has defined what the men in charge profess to know to be the best means of controlling the bollweevil. The means described are nothing but the old rotten stuff that had been dished up for many years, and which has been fully dissected by me during years past, the evidence I thus gave having shown the inadequacy and often utter impracticability of the means advocated by the Bureau, and means were shown by me that gave the result desired. The Bureau has never discussed these means, although they have often told Members of Congress they had done so. The responsibility for this rests upon the Chairmen of the Congressional Committees on Agriculture, who never did anything to force the Bureau to show why the means shown by me should not be satisfactory.

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As the chief means of control is given the early destruction of all cotton plants in the fall. This is a correct idea, provided, first, no one can show you a way by which you can make the plants bear till frost, which I shall show can be done and, second, that this does not cause the bollweevil to adapt itself to feed on plants related to cotton or cause it to accustom itself to live without food during this period. That the weevil is adapting itself to an absence of all cotton in the fall, there is much evidence, and for this reason I shall show how I had modified, during the past two years, my original system of control to meet the requirements of the case.

In his zeal to convince you of the profitableness of the early destruction of all the cotton plants in the fall, Dr. W. D. Hunter, in charge of the work, tells you on page 18 that 410 acres were thus cleared in Calhoun County, Texas, and the profit was \$14.56 an acre. "This was 29 times the cost of uprooting and burning the plants." Thus the work cost \$14.56 divided by 29, or 50 1-5 cents per acre. Can you have this work done at this rate? Dr. Hunter does not tell you that the work was done in 1906 in a section having low-priced labor. Even there the work could not be done now at this cost. But the big little end of the humbug comes in by Dr. Hunter not telling you, with the approval of his worthy chief, what the conditions were. As pointed out as far back as 1908 in my Circulars No. 84 and 85, and carried out more in detail in my Circulars No. 115, 129, 139 and 141, these fields were near the sea, hence weevils hunting in search of food in that direction had not even as much chance of survival as on land devoid of cotton. The nearest cotton was 15 miles away, This seemed to have been but a small patch, for the fields used for checks were 30 miles away. Figuring at a distance of only 15 miles, the 410 acres cleared represented only about the one three thousandth part of the area included in the circle having a radius of 15 miles; hence the weevils deprived of food and scattered over this area in search of it, had in the spring only one chance in three thousand to find food, as compared with usual conditions, where one acre in five is given to cotton, where, therefore, on the average, the hibernated weevil finds food on every fifth acre. Thus under usual conditions the chances of infection in the spring are 600 times greater. If you can plow out the stalks and burn them under usual conditions for 50 cents, there, the benefit will be \$14.50 divided by 600, which gives you a return of 2½ cents for an outlay of 50 cents. This assumes that you can destroy cotton over a territory large enough to make your place safe; and this includes destruction of all volunteer cotton. The tests were made about 75 miles southwest of Galveston. To get anywhere the same results in Tennessee the work would have to be done about September 1st. This

shows the need of a better method, especially in the northern half of the belt.

"Other methods are applicable to different conditions" says Dr. Hunter on page 20, but what those methods are he does not say. But he says. "...The difficulty in one method of removing the plants—that of cutting them off near the surface of the ground with a stalk cutter or ax, is that during mild seasons many sprouts soon make their appearance to furnish food for weevils that would otherwise starve during the fall and winter.. The great objection is that innumerable weevils in the bolls and squares will be allowed to develop." This is correct, but Dr. Hunter is not correct when he continues: "Nothing but uprooting and burning will fully meet the exigencies caused by the weevil, but the burning must be looked upon as an emergency measure especially necessary in regions recently invaded by the weevil and to be replaced by burying after a few years."

As far back as 1913 I had shown in my Circular No. 134 a way that fully met the exigencies of the case, if we assume that the boll weevil cannot adapt itself to feed and breed upon plants other than cotton. If it can— and you will be left to judge whether or not it can—the method in its original form will not answer any more than will destruction of all cotton by uprooting and burning even if done by magic at no cost. The method consisted in showing how the plants can be cut off with the V stalk cutter without giving rise to sprouts.

The V stalk cutter, used as originally advocated by cotton planters left well developed eyes above the surface, about the base of many if not most plants, resulting in sprouts if there was enough moisture. As these sprouts do not offer ovipositing material, the female has to hunt for cotton elsewhere, or else for related plants that give a reasonable promise of successfully serving as breeding material, hence the danger from sprouts consists in that feeding upon sprouts might reduce the rate of mortality existing. There is no conclusive evidence that such is

the case to any appreciable extent, chiefly because the adults, when starved, can fly for many miles to find cotton. However, I had not only shown how these sprouts can be avoided, but also how the field can be turned into pasture within a few weeks after the plants were cut off and burned. Since then, in my Circular No. 151, p. 5, I have shown that the necessity for burning can be removed, as will be shown.

The plan consists in slightly throwing the earth towards the plants at the last 2 or 3 cultivations and sowing a crop of vetches or other legume at the last cultivation. This causes the eyes that do develop near the base of the plant to develop 2 to 4 inches higher up than they would otherwise do. When the V stalk cutter is then used the weight of the tool rests upon 3 points, the nose, and where each arm rests upon the row. The stalks are thus cut off much more evenly and also several inches below the lowest developed eyes, hence no sprouts can appear. The nose of course, must ride upon a shoe of some sort, to avoid injuring the young forage plants. Neither Dr. Hunter nor his Chief, nor any of the members of Congress directly charged by law to guard the farming interests could be made to talk on this point. Yet the Entomologist, as shown throughout my Circular No. 151, has repeatedly told Members of Congress I am wrong all around. Of course it is a disgrace to them to swallow such gab without being shown. Only once with Hon. John E. Raker, as explained in detail on pages 15 to 21 of my Circular No. 151, did the Entomologist go into any details at all upon the various issues he is wanted to talk on, and immediately stopped this upon finding that Mr. Raker gave me a chance at defense by giving me a copy of the reply he got.

If an insect is attacked by a more or less complete, systematic and unseasonable destruction of its exclusive food plant year after year, it will try to adapt itself to survive without this food. That the boll weevil has a strong capacity along this line you can see from a case where in a cage started September 28, 1908

at Mansura, La., by the Louisiana Crop Pest Commission, there survived a weevil which lived till June 9, 1909. This weevil had to survive a temperature that caused the weevils for weeks to crawl on the screen hoping to get away; had no access to water or dew as it would have had outside; had no access to cool shaded places as the weevils have outside; had food removed at once, whereas outside this is impossible, since even if all plants could be uprooted in one day, they would still offer food for several days, making the change to no food gradual. And the rainfall for October was only 0.28 inch.

Again: a cage started October 26, 1908 by the Louisiana Crop Pest commission, with a mean temperature of 51.9 degrees for the week following the caging, gave a survival of 25.12 per cent; while a cage started November 23, with a mean temperature of 70.36 degrees for the week following the caging, gave only a survival of 12.67 per cent. As far back as 1912 I had shown in my Circular No. 128 from the results secured in all of these test cages, by figuring out the mean temperature for the days following immediately the caging, that, at any given time, the high or low survival was regulated by the high or low temperature prevailing immediately at caging time. Since in the open a weevil deprived of food can secrete itself in the woods where the mean temperature is by October 1st somewhere around 55 degrees, early destruction of stalks is beneficial as a means of weevil control chiefly by stopping further breeding.

Plowing out and burning the stalks cannot be carried out in a general way quick enough, if it be done at all, hence under this plan little good results can be expected to follow on the whole. Fields that are cleared, turn off their weevils to fields not cleared, and fields cleared by good management can then produce "a profitable crop through proper methods" as Dr. Hunter shows on page 1, but with all fields cleared and all located alike, infestation of all in the spring will be about the same.

On page 22 Dr. Hunter warms up the old story about a neglected peach orchard across a narrow lane on one side of the

experimental cotton field of 40 acres. "Every season the first weevil infestation in the cotton was found in the immediate vicinity of the orchard."

According to Dr. Hunter to eliminate the hibernating quarters across the lane meant only the prevention of the growth of weeds. But the rough bark of the trees might have been the chief attraction, as was shown to him as far back as 1909, in my Circular No. 102. If the weeds do attract the weevils, I was offering a pretty good means of control when I, previous to 1913, suggested to plant corn around the cotton fields, letting the cotton stalks stand till hibernation has taken place. What weevils then would go outside would mostly go to hibernate in the corn. But then Dr. Hunter violently declared they would go to the woods, So they would, provided the woods are not too far off. Of course both corn and cotton stalks were then to be destroyed by plowing down before emergence could begin. Plowing down cotton stalks was also condemned as utterly impracticable, but now he recommends it himself, that too in the early fall, when the soil is apt to be dry and hard. With the proper use of a heavy chain these stalks can be easily completely plowed in.

Suppose instead of an orchard there had been woodland, what would Dr. Hunter have recommended then? Well, nothing but planting as far as possible away. And as for what numbers of weevils there are out of reach in the woods you gain an idea from page 168 of State Crop Pest Commission of Louisiana Circular No. 31. "...From an elm tree located in the swamp, $\frac{1}{4}$ of a mile from the nearest field, (Spanish) moss was gathered from the limbs at a height of 15 feet. The ground in the swamp was covered with water and a dense growth of cane, 12 to 15 ft. high, occurred all about the tree. In this moss was found 3,158 weevils to the ton..."

But now as to the tendency of the weevil to feed and breed in plants other than cotton; "In laboratory experiments performed by B. R. Coad, a weevil developed in the bud of a wild plant related to cotton. Under natural conditions it has not been

found developing in that plant, but the experiments may indicate a tendency for the insect to acquire a new food plant.." (p. 11)

"May indicate," you see. And if it does? Dr. Hunter offers not the slightest suggestion. "In the adult stage the boll weevil frequently has been found in okra blooms, but repeated observations and experiments have failed to show that it places its eggs in the pods or can develop in them." This apparently while cotton was available. "When confined in bottles the adult weevil will feed upon various substances such as apples and bananas, but this is only under stress of starvation." All this shows that the weevil does possess a tendency to acquire new food plant.

Mr. Coad writes on this point as follows in U. S. Department of Agriculture Bulletin, No. 231, page 3, issued Aug. 2, 1915: "During the summer of 1913, following the discovery of a boll weevil feeding on cultivated *Hibiscus syriacus* at Victoria, Texas, the writer succeeded in rearing the species on buds of this plant, fed them for some time, and noted the partially completed development in buds of *Callirrhoe involucrata* and *C. pedata*, and kept them alive on *Sphacralcea lindheimeri* buds for a short period."

"In the above series of experiments, by alternating foods it was found that the weevils have a wide range of hitherto unsuspected adaptability. This discovery makes the presence of malvaceous plants in the vicinity of cotton a possibly important factor in the ultimate control of the species...."

Of course, as long as there is cotton, the weevil wants nothing better. But with the food supply cut off more or less every fall, the weevil has the choice to learn to starve along, or to feed and breed in related plants. As there is a good supply of related plants available, destruction of cotton becomes yearly more and more harmless to the weevil. Thus in this event what Dr. Hunter now offers as the chief means of control loses its value.

Were once the weevil accustomed to breeding in plants related to cotton, this would be likely to extend the period of

breeding both in the fall and in the spring. All this shows the need of a method of control that will make it possible to actually kill the weevils and without scattering the weevils to plants other than cotton. Dr. Hunter has absolutely nothing of this kind. I shall describe such a way evolved by me during the last three years.

In the case of infestation from the peach orchard above referred to, Dr. Hunter says: "...the infestation always started at that point and radiated into the field..." This brings up the question of what might be done to reduce the number of hibernated weevils in the spring.

Woods, or even only vegetation of scrubby growth, or a strong stand of grass would all have the effect of enabling large numbers of weevils to survive the winter. Pastures and meadows should not be closely cropped for several very good reasons, the chief ones being to avoid erosion and enable them to withstand the effects of winter. All such make good hibernating quarters for weevils and other insects, injurious, beneficial and neutral ones. What is the use to talk about the benefit to be derived from beneficial insects, or birds, if you give them no chance to survive?

How these and other places, such as sorghum stubble, can be cleared of weevil better than by any other way except perhaps burning, which is highly injurious and causes erosion, will be shown later.

On page 22 Dr. Hunter calls attention to sorghum stubble as highly favorable for hibernating places. "A little work in the fall or winter will result in the destruction of practically all of the weevils found there." Wherein this "little work" does consist he is careful not to say. If there is any little work that approximates such results other than striking a match while the stubble is dry, I do not know of it,

Slopes and river banks must be protected by rough vegetation to prevent erosion and provide protection against damage

by floods. For details see Yearbook Separate No. 688: Farms, Forests and Erosion.

I had shown as far back as my Circular No. 117, in 1910, carrying it out minutely in my Circular No. 127, 1912, from the results of tests made by Dr. Hunter, that the weevils as they arrive settle at the edge of the field. I showed that as long as there are no squares they stay at the edge. Thus in case infestation starts at a point, or at a side near timber or a fence row, the weevils will be practically all at this point or side, clustering to the outer rows as long as there are no squares. It has been shown that 50 per cent of these might be killed by an application of poison. But when squares are set the use of poison ceases since the weevils begin to feed within the squares. The females as a result become fit to oviposit. With the squares few and far between, they at once scatter all over the field. I showed from this at that time that the only economical means of controlling hibernated weevils would consist in picking the weevils off the edge of the field beginning with the setting of squares, every day, at least while there is warm weather. This has to be kept up till emergence is about over, which usually takes 3 to 4 weeks. Thus, if a female is caught on the edge, it saves hunting for her offspring, represented by about 139* infested squares, later on, scattered all over the field. This latter way, however, is the now officially approved way, approved as far as you can carry it out—it is all up to you. The scientists in charge are foxey. The correctness of the statements made by me was never disputed by them, Nor has any member of Congress insisted to be shown why I should be wrong.

In 1915 I realized that the problem of how to control the New Mexico range caterpillar can be solved by the judicious use of poultry, explained in detail in my Circular No. 151.

This in turn led me to realize that while the plan of securing hibernated weevils as just described was a good one, it would often be difficult to secure the proper help to get the desired results, and that poultry could be used to advantage, this the more as poultry could be used the year around. Take the

*This is the average number actually found in tests

case of the weedy peach orchard, for instance. If the weevils hibernate in the weeds, and poultry had the range of the orchard during fall and winter, the poultry will secure most of the weevils before emergence. Again, given access to the orchard and across the lane during spring, they could easily see the emerged weevils feeding on the young cotton. Further, as squares begin to fall it is natural for poultry to pick on these, since they suggest a juicy grub within; they thus attack the adult, the larva and the pupa. This naturally keeps down the weevil and results in increased production. This the more as poultry also controls other cotton insects. This includes the bollworm, as will be shown. Moreover, it will be shown how poultry can be assisted by the use of trap-plants, and how this enables the field to produce fully up till frost.

The Bureau's way is quite the opposite. They emphasize the need of securing an early crop. "What is needed is a variety which will mature quickly and set a crop by a date not later than the middle of July. In humid regions with heavy infestation the most productive varieties have been found to be King and its principle derivatives, namely, Simpkins and Broadwell. In recommending these varieties the Department reminds the planter that they produce lint of a very short staple... The varieties may safely be replaced by large-boll varieties in other regions." What other regions? Well regions not humid. This means chiefly West Texas, Oklahoma and North Arkansas. Thus all the rich lands in the humid regions are to grow the King type. What you want is a means of control that makes possible the growing of long-staple and Sea-Island cotton where it was grown before the advent of the weevil. As long as you have not done this you have not solved the problem. If you have a variety that sets a crop by the middle of June, you would simply cut the season that much shorter. By clearing the fields in the fall, driving the weevils away to other fields not cleared, and then racing along for an early crop by all means known, such as selecting a perfectly drained field, best of cultivation, proper fertilizer and especially an early strain of seed, you can easily out-

run your neighbor, as shown by me as long as 13 years ago in my Circular No. 31, but such a course means simply winning at the expense of the neighbors, because as soon as the earliest field becomes at all well infested, there starts an exodus of weevils bred there for nearby fields having as yet a lower infestation of squares. As not all lands are alike and cannot be made equally early, the men with 'proper methods' comes out first at the expense of the man riding a slower horse.

The planters in a section might agree to not plant before a certain date, for all now realize that the earliest fields serve as a weevil nursery, but not all fields could be rushed along at the same rate.

If the fields are kept patrolled by poultry while young, the weevils cannot get plentiful enough to do any appreciable damage. That poultry can secure this result, is known from what poultry did in at least one very similar case, the alfalfa weevil. Details are given on page 10 of my Circular No. 151. The Bureau of Entomology had now two years in which to make all the tests they wanted to satisfy themselves if benefiting the public is what they are after.

After considerable fruit has set, squares become scarcer and, if the weevils are sufficiently numerous, as they are under the present official methods, infestation of bolls begins. But squares are preferred, because the female knows a new generation can be produced in them quicker than in bolls. The scarcity of squares thus naturally causes a constant movement in search of them. It is all theory what I say, is what Chief Howard tells members of Congress that make an honest attempt to get at the truth. First let him point out what is theoretical here or anywhere else.

Inasmuch as we do know that destruction of all cotton in the fall, following the law of self preservation, does develop a tendency of the weevil to subsist on and breed in plants related to cotton, which is easier to acquire than the ability to go without feeding and breeding during the absence of cotton, I had shown in my Circular No. 148, page 13, that, provided poultry

is not able, through lack of numbers or any other cause, to so keep down the weevil as to make the cotton bear till frost. it will be unwise to cut off all of the plants when they are no longer producing profitably and that a small part should not be cut off. These plants then are to serve as traps. These plants, it was shown, could be rolled down so that poultry could have access to the tops and keep on picking the weevils off.

Using trap-plants is the more necessary as destruction of all cotton plants includes also the destruction of volunteer cotton scattered all over the country, work that is no one's particular business. Unless destroyed these plants can, and will, in the absence of all other cotton, attract and sustain vast numbers of weevils. Then again since the boll weevil has been actually bred on *Hibiscus syriacus*, and this plant occurs there plentifully, and there are numerous related plants, destruction of all of the plants in the field would have lost its value as a means of control anyway, and a supply of trap-plants tends to keep them to cotton, their original and preferred food.

A better way of concentrating the weevils was pointed out, however, in my Circular No. 149. This consisted in planting a small patch of cotton very late, say in July, for no other purpose than providing an abundance of squares in the fall. Any kind of seed, except a late variety, will do. Weeds in the rows are kept down by one or more harrowings before, and possibly immediately after, the plants are up: there is no thinning or hand weeding of the rows; the patch is cultivated as usual and should be sown as a crop of vetches at the last cultivation. Thus there is very little expense. This patch will then attract the weevils, since the females then do a great deal of flying in an attempt to place their 139 eggs on the average, to as good advantage as possible. And poultry can easily find them there. Feeding a little grain there daily would cause poultry to stay there by preference. Where practicable these patches might be located within a poultry-tight fence. Doing this will give positive evidence what value there is to these trap patches. This then results in the cotton-field keeping on bearing till frost. Thus there is

done away with the danger of complicating matters by having the boll weevil become accustomed to other food plants besides cotton.

In an exceptionally dry season, cotton planted thus late might not sprout. In that case some rows of the old plants might be cut back so as to produce an abundance of squares. These plants would have to be rolled down to bring the weevils within reach of poultry.

Such trap-plants, it was pointed out, would of course be preferred to the older plants by many other insects, and it was shown this is of special importance in the case of the boll worm.

In my Circular No. 150, p. 9, I quoted the Bureau from Farmers' Bulletin No. 290, p. 30 as saying: "Several instances have come under the writer's observation in which cotton adjacent to barns, where chickens, turkeys and guineas were kept was practically free from bollworms, while at some distance out in the fields the injury was quite severe."

In the cases in question poultry, apparently, was not present in sufficient numbers, or was not used to proper advantage. A little grain scattered over the parts not kept clear would probably have induced the poultry to extend its range of feeding to these points.

Such trappatches of cotton with an abundance of squares make the most favorable oviposition material then available for the bollworm. What specimens finally succeed in entering hibernation do so by pupating about 2 inches below the surface of the ground. As stated these patches should have been sown to vetches at the last cultivation. There is no hurry to destroy these plants after having been killed by frost. Besides bollworm pupa, this patch is apt to harbor boll weevils, and other insects. Because of this variety of insects, the patch should be plowed down when emergence of weevils begins.

In the North a little patch of corn sown in August offers the very finest oviposition material for the hibernating brood. This corn need not go to waste. It may be pastured off, or hogged

down at the approach of frost. This patch must be plowed down in the North early in May to prevent any pupa in the ground to escape as adults.

It will readily be seen that by providing a trappatch of young cotton to concentrate the last generation of the boll weevils, and also of the bollworm and many other cotton insects, and having poultry at work, there is no good reason why the cottonfields should not produce up till frost. In any case the plants in the field are to be cut off with the V stalk cutter as soon as production is practically at an end. There is no need to burn these plants, since most if not all weevils that may yet emerge from squares and bolls on the cut off plants would find their way to the trappatch of late planted cotton. The cotton field thus is turned into a pasture within a few weeks after the cutting off of the plants. These plants left to rot, become overgrown by the vetches, and are buried in the early spring evenly and completely by the use of a heavy chain in connection with the plow.

After there is no more cotton, poultry can hunt for weevils and insect in general in the many places that may serve as hibernating quarters. None of these should be burned over.

There has recently appeared U. S. Dept. of Agr. Bulletin No. 564, giving the results of tests on the collection of weevils and infested squares as a means of control of the cotton boll weevil in the Mississippi Delta. In substance, as there given, the result comes to this: "...It seems to the writers that in a year of light infestation a slight degree of benefit may be secured from the picking operations, but that in a year of average or heavy infestation this benefit is completely lost..." (p. 44). It is shown there at length how utterly impossible it is on the average to secure the labor necessary to do the picking, or, to put it another way, if other crops are neglected because of this picking, the loss to the crop per day per man is given as amounting to \$5.11. Thus we now have radically different figures from what the U. S. Entomologist has dished up some years ago when he claimed, tests had shown a profit of \$3.22 per acre, implying

then that labor and conditions could be generally secured to get such results.

Moreover, "The discovery of the injurious effect of the use of bag and hoop (collection of weevils and infested squares) on the plant is of great importance....the studies...have shown definitely that the use of this semi-mechanical picker cannot be recommended," (p. 50).

As to mechanical pickers: "The failure of the mechanical picker to give satisfactory results is very discouraging...This picker was so injurious to the plants that it actually reduced the crop considerably," (p. 51).

Then why not make a judicious use of poultry? Under date of Feb. 28, 1917 the Secretary of Agriculture wrote to Hon. John E. Raker, who made an attempt to get at the truth, as follows as regards the use of poultry and a trappatch, described in this Circular, and originally presented to him in my Circulars No. 147 to 150: "...Mr. Reinlein's suggestion is that chickens be provided in sufficient numbers to destroy all or most of the weevils as soon as they make their way into the fields."

The fact is, when in my Circular No. 147, 1915, I pointed to the use of poultry as a means of controlling the boll weevil for the first time, I showed its use to be possible not only during the period of emergence, but also on fallen squares, and as for control after the plants were cut off, I stated on page 23: "...the plants cut off with the stalk cutter furnish subsistence for weevils till dry, and the weevils can be picked off meanwhile by the use of poultry."

This method was improved by showing in my Circular No. 148 that a few rows might be left standing as this then will hold the weevils to their original and preferred food plant, These trap rows, by being rolled down, would then attract weevils till killed by frost, and at the same time would carry the weevils low enough to be reached by poultry. Finally, in my Circular No. 150 I showed that by growing a trappatch of late planted cotton, the weevils are concentrated there during all of late summer and fall.

All this the Secretary's humbugologist deliberately ignores, and specifically claims all this and certain other matters relating to the range caterpillar and the Argentine ant, discussed on pages 15 to 22 of my Circular No. 151 to be impractical, but, as always in the past, carefully refrains from making any attempt to show why this should be so.

As far back as my Circular No. 127, 1912, I had shown that once you fail to secure the weevils at the edge of the field as they emerge from hibernating quarters outside of the field, and before they begin to breed, control becomes impossible, because not only will each female infest on the average 139 squares, but these squares will also be scattered all over the field, and moreover before you can find any infested squares you have to stand by for two weeks or more allowing the weevils unhindered entrance, thus increasing the work hopelessly.

It will thus be seen the Bureau of Entomology has really no tangible means of controlling the boll weevil, first, because destruction of the plants in the fall by plowing out is too slow and the weevil is learning to adapt itself to absence of cotton, both by learning to go without any food, and by learning to feed and breed in plants other than cotton, and, second, because collecting weevils and fallen squares has been shown to be entirely impracticable. Early planting and use of early varieties can make a good showing only in individual cases, because if universally practiced it will enable the weevils in all of the fields to start breeding that much earlier. That is, many females that would otherwise die before they could oviposit, will thus become enabled to oviposit, and later emerging ones will find an abundance of squares, where otherwise they would find a scarcity; this then accelerates ovoposition.

The Chairmen of the Congressional Committees on Agriculture, Senator Thomas P. Gore and Representative Asbury F. Lever, are to blame for permitting the Bureau to dodge the issue from year to year.

Because of this, upon the issuance of my Circular No. 151, I undertook to see what could be done to interest the officials in

charge of agriculture in the States that are chiefly affected by the control of the insects there discussed.

In Circular No. 151 I purposely went minutely into detail in regard to the use of poultry as a means of controlling the New Mexico range caterpillar, because there is nothing complicated either about the problem or the means of control advocated by me, I made every effort to get Representative W. B. Walton of New Mexico to ask the U. S. Entomologist to define his position. Mr. Walton took no action of any kind. Both of the U. S. Senators were posted. Senator A. B. Fall made no reply. Senator A. A. Jones twice promised to look into this matter.

I had tried to interest the State Officials as early as I had worked out the system of control in my Circular No. 146, 1915, and they were wanted to render an opinion on it and test it out to their own satisfaction.

This insect as egg, larva, pupa and moth is accessible to poultry the year around, and is fit food for poultry except as more than half grown caterpillar. The Bureau of Entomology on the other hand has no means of control, except what may be possible by fostering parasitic and predaceous insects. As this insect is now also attacking cultivated grasses and grains, it is obvious that control by parasitic and predaceous insects alone is entirely inadequate, even when the pest is comparatively scarce on the range.

In New Mexico the Director of the Experiment Station is in charge of agricultural matters. When addressed he expressed himself favorably toward having the matter fully discussed by the State Entomologist. As this was not done, however, I called his attention to it. There then came a reply by the State Entomologist, at least touching upon a few things connected with the matter and the sum of all was this: "I regard the government's method of investigation" [relying on parasites] "as more natural and more productive of permanent results than is your method."

Yes, that method must be regarded as more natural and more productive of permanent results, just as the moon is more natural and more productive of permanent results as a lantern than is any other means of lighting during the night, but men find it necessary to employ other means in addition to get light when and where it is wanted.

The natural enemies often fail, in fact, the Government gives it as its belief that this is what caused the insect to become prominent as a pest; and for this very reason, since the Government wants to humbug the people by telling the people lies, claiming my plan consists in having the caterpillars eaten by turkeys, the State Entomologist can be expected to state his side. As it is, if a rancher or farmer has his ranch or farm threatened by the caterpillars, as far as the State Entomologist is concerned, there is no help; whereas if poultry had had the run about the range, they would have minimized the eggs, and minimized the young caterpillars. Further, they would the fall before have minimized the pupae and minimized the moths. Thus the pest could not become greatly injurious to crops. That this is so was shown at length in my Circular No. 151 from official evidence referring to feeding habits of wild birds and of poultry in regard to insects in general, and the gipsy- and browntail-moths, in their various stages, in particular.

These last two pests, it is shown there at length, when taken as forest pests, are beyond any control as far as means advocated by the Bureau of Entomology are concerned. The proposed plan of changing the deciduous woods as far as practicable to conifers encounters, admittedly, a serious difficulty because of probable attacks by the white-pine blister rust; and then I had shown on pages 35 to 38 of my Circular No. 151, there is now present the European pine shoot moth, which destroys the apical bud, causing crooked pines. The remedy the Bureau advocates is 140 years old, and consists in removing the infested apical shoots. The remedy I pointed out as far back as in 1915 consists in protecting the apical bud by an application of semi-liquid clay before the beginning of the ovipositing period. The U. S. En-

tomologist was all along urged to show what might be wrong or impracticable about this method, but he all along maintained absolute silence.

There has recently appeared Farmers' Bulletin No. 845: The gipsymoth and the browntail moth, and their control. On page 1 are shown about 50 female gipsy moths depositing eggs on a tree trunk. Thus here you see moths and eggs in quantity where they would be within reach of poultry. Probably 12½% of all the eggs are thus oviposited. Add to this other places within reach of poultry, such as stone walls and low vegetation, and we have probably a total of 25% within reach of poultry, although a fourth of these are apt to be deposited out of sight.

On page 24 you read: "...planting of white pine might be done to advantage, but... the question... must be decided by the owner..." and "The presence of.. white pine blicterrust.. should receive due consideration..." The presence of the European pineshoot moth is ignored. Thus all the Bureau's advice just comes to this: You pay your money and take your choice.

On page 31 of my Circular No. 151 I had shown from Year-book Separated No. 700 that turkeys greatly relish acorns and that where these are plentiful but little grain need be used for fattening them in the fall. This probably also holds good with chickens. Now, oaks are very plentiful in the territory infested by the gipsy- and browntail moth, and as they are officially admitted to eat moths in common with many birds much smaller, they can be profitably used to at least help to control the gipsy moth.

Mr. S. A. Weiant, Scientific Assistant in Poultry Husbandry, who wrote Separate No. 100 under date of January 9, in regard to my inquiry, mentions in addition as available nuts, beechnuts, chestnuts and pine nuts, thus showing that the woods offer rich feeding ground.

Elimination of oak, scrubapple and wild cherry is specifically recommended on page 24 of No. 845 as greatly assisting in reducing the number of browntail moths. But the insect can subsist admittedly on almost anything except conifers.

The Bureau of Biological Survey publishes literature on how to attract birds, and lays special stress on the value of fruit bearing shrubs and trees, while the Bureau of Entomology urges their eradication, for they are host-plants to practically all the insects and fungi that attack the cultivated trees and shrubs. Wild birds cannot be strictly controlled, nor can they be owned, but poultry can be controlled and owned. Nutbearing trees and shrubs, wild, and planted and grafted, are one of the very best plants to use to clothe sidehills with to prevent erosion. These nutbearing trees, in common with other vegetation, are affected by insects and fungi, their greatest enemies being weevils. All these weevils pass the winter as larva in the ground. These larvae in the fall and spring are near the surface and can be found by poultry. Hogs can admittedly be fattened by being given access to eat up the nuts that are not gathered or are wormy,

It cannot be denied that it is in accordance with the law of nature that all lands not fit for agricultural purposes should be kept in timber of whatever kind best succeeds, in a given locality, and that the steeper the slopes the more necessary it is that the undergrowth and ground covering should be interfered with as little as possible. Thus the woods will harbor many plants that would, for instance, sustain the apple maggot. These plants would include haws, crab-apples, huckleberries and blueberries. Under primitive conditions the fruits of these plants are eaten by bovines and other animals. and to avoid having them serve as sources of infestation to cultivated plants, it is clear that cattle, horses, hogs and sheep should have access to eat the fruits. Poultry will be of benefit chiefly by securing larva and pupa from the ground, the period extends for about nine months in the year.

Take another case: The larch sawfly does often very great damage in north-eastern New England, The Bureau of Entomology has no means of control to offer. The insect passes the winter as pupa inside of a cocoon in the rubbish beneath the trees, during 10 months out of 12. I had shown in my Circular No.

149, pp 16 and 17, that poultry in large numbers, and giving them the run under supervision of man over the tracts thus affected, solves the problem. Besides when plentiful these caterpillars crawl in great numbers on the ground, and make fit food for poultry, being devoid of poisonous hairs.

A similar case of importance: The grape berry moth passes the winter as pupa in a cocoon, usually spun on a grape leaf during October. These leaves, normally, are blown together during the winter in sheets, and there hibernation takes place. What is needed, clearly, is to give poultry access to these leaves.

Preserving as far as practicable the natural undergrowth everywhere is necessary to secure the more nearly even flow of rivers, through holding the rainfall instead of having the water rush off to the sea, filling up the rivers with sediment at one time, and failing to have the rivers give the flow they are normally capable of at other times.

Further: The more vegetable matter is thus allowed to accumulate on non-agricultural lands, the less will there be vegetation that will dry up during the late summer and fall, consequently the less will be the danger from fire.

Still another thing: Some insects are held more in check by fungus diseases than by parasites. These fungi do not develop in the absence of moisture. There is good reason to believe that the range caterpillar is normally kept in check more by fungus disease than by parasites, for as it feeds on or near the ground, fungus disease developing during a spell of hot, moist, weather, has a specially good chance to get a hold. However it is well known that the range has been kept overstocked for years. Thus it is easy to see that absence of enough vegetation to hold as near as feasible what precipitation there occurs—and it occurs there mostly in the form of sudden heavy local downpours—failed to provide the conditions necessary for the developement of the fungus. These conditions require the presence of a certain amount of humus. Thus it is highly probable that the Entomologist and his trained scientific Staff, and also the New Mexi-

co State Entomologist, are altogether watching the wrong hole as far as natural agencies of control are concerned.

What can be done? On the open range nothing can be done, unless laws are enacted to enable the stockmen to fence the land popularly considered to be each man's range—the land half the distance from each man's watering place to that of his neighbor's. This matter is very ably discussed in U. S. Dept. Agr. Bulletin No. 211: Factors affecting range management in New Mexico. The greatest stress is laid on the necessity of avoiding erosion, and the chief remedy pointed out is avoiding close grazing.

Just for contrast how is this: "Under certain favorable circumstances the winter burning of restricted areas has proved of great benefit in destroying the over-wintering egg clusters. Cultivated areas usually may be protected by winter-burning the surrounding egg-bearing grass, weeds or other vegetation. However such burning destroys the grass crop for that year..." (U. S. Dept. of Agr. Bulletin No. 443, p. 11.)

Avoiding close grazing, then, produces conditions more suitable for the development of fungus disease in summers of more than normal rainfall. Overstocking has been going on for many years. If the range caterpillar has become plentiful because of the absence of insect parasites, as is officially claimed, overstocking would seem to have been the cause. If so, there then is no good reason to expect that breeding parasites would be of benefit as long as close grazing is not avoided.

Of the introduced natural enemies 3 kinds of large ground beetles (*Calosomas*) are considered to be among the most important. As far back as 1915 in my Circular No. 147, p. 16, I had quoted evidence from U. S. Dept. of Agr. Bulletin No. 250, The *Calosoma sycophanta* in New England, and showed that skunks, raccoons and foxes destroy large numbers of the beetles before they can emerge from the ground and climb up the trees and that, because of this, they are kept rather scarce even in woodlands, where after emergence they are out of reach of ground

inhabiting vertebrates. On the range this is not the case, hence this beetle has there not the slightest chance to become a factor in keeping down the range caterpillar,

Because of this, it was shown that in making systematic use of poultry for control the thing to do is to trap or shoot the skunks and other predatory animals, bringing in at the big prices paid for good furs considerable money, and at the same time this serves to protect the larger stock, especially sheep. This can be easily done because the poultry is to be corralled at night within a moveable woven wire fence, and the predatory animals will nose around outside.

Copies of my Circular No. 151 were sent to the State Entomologist of four of the New England states most affected. I also made other efforts to get officials of these states to act. Only one of them made any reply. He said: "The possible benefit that might arise from the use of poultry for a means of destroying gipsy moth eggs is problematical..." Exactly. The attention of the Bureau of Entomology was called to this in 1915, and instead of carrying on tests, they now claim I am wrong on this and everything else. Since about 20% of the eggs are within reach and about 75% of these are within plain view of poultry, and these are present at a time, during the late fall, winter and early spring, while animal food is scarce, poultry will naturally feed heavily on these. Then since the caterpillars, especially while young, frequently lower themselves it was shown, they thus also often come within reach of poultry. To what extent they then thus can destroy the pest is thus also left to be problematical, this while Congress is appropriating special funds for just this purpose.

The gipsy moth caterpillar exists in six stages, since it molts five times. The several lengths are $\frac{3}{8}$, $\frac{1}{4}$, $\frac{5}{8}$, $1\frac{1}{4}$, $1\frac{1}{2}$, 2 5-16 inches. It takes about 50 of the third stage caterpillars to equal the bulk of one specimen of the sixth stage. The New Mexico range caterpillar passes through the same stages, but length

and bulk is materially greater. Chickens having the run of woods can thus destroy vast numbers of young gipsy moth caterpillars without even feeling satisfied, and that, too, without any injurious effect on their health. It is the same with the range caterpillar.

On pages 32 to 35 of my Circular No. 151 I described what is an easy and sure means of controlling the sugar cane borer moth. Since the Bureau of Entomology would not speak I tried to get the Louisiana Sugar Experiment Station to state its position. They did nothing of the kind.

The means outlined rests upon the fact that the borer prefers young corn for breeding, and also takes advantage of the fact that the moths hang on the plants during the day, thus enabling poultry to secure at least part of them. Trap patches of young corn are provided during the whole season especially in late summer and fall to attract and hold the last brood, which upon going to hibernate in the ground is then destroyed by plowing. This plan not only protects the cane, but also makes possible the growing of an adequate supply of corn on a sugar cane plantation.

As cane supports the mealy bug, and as the presence of the Argentine ant results in an estimated five-fold increase of the pest, I had asked also the Station what they think of my plan of using poultry to control this pest by scratching up the shallow nests, as discussed on pages 19 and 20 of my Circular No. 151. They did not reply.

With the boll weevil now covering most of the South Atlantic States, territory that used to grow much long staple and Sea Island cotton, and the Argentine ant getting a good foot-hold there also, I wanted to see what the State Officials of the Gulf and South Atlantic States would do when shown the facts as given in my Circular No. 151. Only two made any reply at all. While the two replies in question did not go into any details, they at least showed that the offices they emanated from are oc-

cupied by men and not by scared rats.

How is this for a straightforward reply: "November 8, 1917 will state that it has never been the policy of this department to participate in controversies that do not concern us. We are not in any way interested in your controversy with the U. S. Bureau of Entomology. The men who have conducted experiments on the boll weevil and other insects, for the Bureau, are among the most able men in this line of work to be found in this country, and we have no reason to disagree with them in recommendations which they have made as results of their investigations, State Entomologist."

This man is at least candid. But have his Commissioner of Agriculture ask him whether the U. S. Bureau of Entomology has made any recommendations satisfactory or otherwise, to control the Argentine ant at large, and he has to admit they have nothing of the kind, a matter discussed on pages 19 and 20 of my Circular No. 151. Ask this man whether the means of controlling the boll weevil as advocated by the Bureau are all that can be desired and he has to admit that a really satisfactory means of control must make it easily practicable to utilize the whole season all over a given region. The people of his state are manifestly agreed that he should be interested in these things. His ability to serve his people is at present confined to stating his view of the merits or demerits of the case, so that the representatives of the people of his State in Congress may know the reason. Claiming to have no reason to disagree with the Bureau implies a condemnation of my method, and an endorsement of the Bureau's method. and calls for an explanation why my method should be condemned. And failure to make such an explanation in the first place, implies he cannot make any.

The other reply came from the State Horticulturist of an adjoining state. He stated after having a copy of my Circular No. 151 for a day, that he finds it very interesting, but is unable to get the proper view point, because he does not know who I am and why I write these circulars. Thus here, for once, you have

an unspoiled, guileless soul to start with.

He was told, in essence, that the U. S. Bureau of Entomology does not hold a corner on brains, that to present my case and protect myself I have to use copyrighted books; that as long as I do not get fair play the matter keeps out of general circulation; thus that, for instance, the cotton planters have to use the method of controlling the boll weevil the Bureau describes and claims to be good, when it is actually worthless, and when there can be made available one that is good, and that to get fair play I want to find out whether the State Entomologists are willing to do the right thing by their states and define their position. He was told his State Entomologist, through his former connection with the Bureau of Entomology in boll weevil investigations, knows me well enough for all practical purposes, and is an ideal man to point out any sore spots that might exist on the method of boll weevil control, as described in my Circular No. 151. There was no further reply. Evidently his State Entomologist succeeded in prevailing upon him to do nothing in the way of stepping on Chief Howard's corns.

What is known as white pine blister rust has been described in Farmer's Bulletin No. 742, issued June 9, 1916. It is claimed there that the pines suffer from a rust, and that to prevent that rust upon pines, it is necessary to destroy all currants and gooseberries—wild and cultivated.

I shall show that the pines suffer from a cankerous disease, and that what is known as rust on the pines is the hibernating form of a fungus disease affecting currants and gooseberries, and this rust, on pines, affects merely decaying tissue, and does, therefore, no damage to pines, and destruction of the currants and gooseberries would not in any way stop the cankerous disease; shall show it all, too, from the statements of the author, Mr. Perley Spaulding, Forest Pathologist.

According to Mr. Spaulding infection of the pines takes place through what is known as teliospores, produced in late summer and fall upon currants and gooseberries. These "...fal-

ing upon bark of suitable age on white pine, may in turn germinate, penetrate the bark and grow in the inner layers during the incubation period..."

I shall show that the "suitable age" has nothing to do with the germination of these teliospores, but that the cankerous disease requires for developement the parts on pines that are of suitable age, and that these teliospores cannot germinate upon, and penetrate, the bark of healthy pine that is suitable for the development of the cankerous disease.

"A period of incubation follows the infection of white pines. This period may vary from less than one year to six or more years. [p. 11]Then the bark begins to swell at the point of infection...,the parasite pushes forth, through tiny openings in the bark, small drops of a clear, sweet tasting fluid. This is not pitch. In it, if examined by a microscope, immense numbers of tiny spore bodies. These may be found early in the spring before the formation of the blisters described below, or they may occur apparently at almost any season in late summer and fall. What the function of these tiny spore bodies may be, nobody knows. They occur in a considerable number of closely related parasites, but they are not known to reproduce the disease in any way. They are simply indicators of the disease. They are known as pycnospores. Shortly after the pycnospores are produced, from the latter part of April until the middle of June, the real fruiting bodies push their way through the swollen tissues of the bark... known as aeciospores or *Peridermium* spores....If one of these falls upon a leaf of a currant or gooseberry it is able to attack that leaf....These new spores...are called uredospores....a new generation of uredospores being produced every two weeks.... From the latter part of July until the fall of the leaves. Still another form of fruiting body and of spores is produced...These are known as teliospores...,in order to carry on the disease they must attack the bark of young white pine or young parts of old white pine.... This infection of the pine bark must take place in the late summer and fall. If the parasite finds conditions very fa-

vorable, it may produce the sweetish drops of liquid with the pycnosporos early the next spring and shortly after that it may produce the blisters containing the Peridermium spores.... Because of the fact that the peridermium spores produced upon pine cannot infect pine and that the teliosporos produced upon currants cannot infect currants, we immediately perceive that if the two sets of host plants are separated widely enough so that the spores produced upon one cannot reach the other, the disease cannot spread." (p. 14).

Wrong. The teliosporos germinate only on parts of pines previously diseased, and which are producing the pycnidial drops. These teliosporos penetrate the diseased bark and in the spring produce the Peridermium spores, and nothing else. That they do not produce the pycnosporos is proven by the fact that the pycnidial drops "may occur apparently at almost any season in late summer and fall," because there are then no teliosporos to produce them. To claim that the pycnidial drops containing the pycnosporos are simply indicators of the disease, is little short of absurd. We know that in the case of the pearblight there are similar exudations and the disease is spread by insects feeding on them and infecting other trees.

We have to do in this case with a disease of pines, very much what pearblight is to pears. The disease is spread by insects—wasps, bees, flies etc., in the case of the pearblight—carrying the so called pycnosporos to parts of pines susceptible to attack. If all the currants and gooseberries were eradicated—and this is the means of control proposed—there would be no uredosporos to produce teliosporos to germinate on diseased parts of pines and produce peridermium spores in the spring, but the disease that is really killing the pines is then there as before.

What can be done? The fungus disease on currants can easiest be kept down by an occasional slight licking of the under side of the leaves with a hot air blast torch, a suitable type of which is shown on last page. This was pointed out by me as far back as 1898, but the Bureau of Plant Industry never made any tests to satisfy themselves.

What actually kills the pines is a bacterial or cankerous disease, similar to pearblight. As far back as 1903 I had called the attention of the Bureau of Plant Industry to the possible use of heat from a hot airblast torch, through repeated slight lickings, upon these exudations. They said, it might be of some value, but nothing was done to test it out.

These pycnospores are not spores at all, but are microbes, and the sweet tasting fluid they are in serves to attract animal life to carry the disease to other plants, same as in the case of the pearblight, as will be shown.

On page 25 of my Circular No. 139, 1913, I described what I considered a much better method, in fact, I propose to show that it is far the best thing that can be used of anything now known. I give the original description in full.

"If the use of a torch should be shown to be of no value in this case, I would consider that smearing the exudations over with some such matter as air slacked lime, or a mixture of it with clay, carbonated or otherwise, made strongly disinfecting, or not, as tests may prove to be best, applied dry, or probably more successfully in paste form with a plasterer's trowel, would permit the tree to throw off matter it wants to throw off, but would not permit the insects to have access to it. Of course, this paste, after getting dry, is quite liable to crack, due to evaporation as well as due to the growth of the tree, but these cracks it should be easy to fill up by dashing with a paste brush or a suitable broom some more of the same stuff, in more liquid form, over the stuff already on. To thus prevent pear blight, or what is also called fire blight, and control diseases of similar nature, work on covering up the exudations or the spots where they are breaking out must naturally be prompt for best results. Possibly a semi-liquid smear, applied with a paste brush, will prove to be best."

According to the Secretary of Agriculture, that, with all else I have pointed out, is theory and all wrong. Let them examine the evidence following and show what is wrong: Pear blight "attacks and rapidly kills the blossoms, young fruit, and new twig growth, and runs down in the living bark to the large limbs and

thence to the trunk...." (Yearbook U. S. A, 1905, p. 295.) "Pear blight varies in severity...the microbes travel about... notwithstanding the fact that they are surrounded and held together and to the tree by sticky and gummy substances..." (p. 296) The pear blight microbe is a very delicate organism and cannot withstand drying for any length of time..." (p. 297) In early spring....it spreads rapidly and the gum is exuded copiously from various points in the bark and runs down the tree in a long line. Bees, wasps and flies are attracted to this gum and undoubtedly carry the microbes to the blossoms.., (p. 298) The key to the whole situation is found in those cases of active blight [comparatively few] which hold over winter. If they can be found and destroyed the pear blight question will be solved.." [p 298] "The only really satisfactory method of controlling pear blight.. is... by cutting out and burning every particle of blight when the trees are dormant, [p. 299].. in the orchard or within a half mile or so from it. Every tree of the pome family [apple, pear, quince, crabapple, mountain ash, serviceberry and haws] should be examined for this purpose, the blight being the same in all..." [p. 300.]

This cutting out is too severe a measure. The cases of blight that hold over winter are usually found on big limbs or on the trunk of the tree. To cut them out there involves making a dangerous wound, inviting attack by fungi and by insects. In addition this work of cutting and burning is very slow. If cutting be practiced, the health of the tree requires that the great wounds thus caused be protected, involving much time and expense.

It is obvious that it is as safe to say that the key to control consists in rendering the exudations in the spring harmless, since they, admittedly, contain the microbes. In an orchard the

plan shown by me would consist in covering the exudations with some suitable smear to absorb the moisture, thus both killing the microbes and keeping off the carriers of the disease. Merely digging up some soil or a clump of grass and rubbing over the places where the exudations occur, beginning when they are about to occur, and going over the trees every few days, to supplement this where necessary should be all that is needed. This course will then enable the tree to heal the canker over and incidentally to keep out insects and fungi. This would seem to be the only feasible course on wild trees. These moreover are usually not on the orchardist's land.

It will be seen that this course would also fit a similar bacterial disease of the plum and related stone fruits.

I do not consider that this course is feasible on white pine trees, covering forest lands. I consider that the most feasible course consists in taking a little white pine or other handy evergreen branch and slap this about the infested parts of pines and do this while the pycnidial drops are produced, especially in the spring. It would seem certain that this causes the pycnidial drops to dry up, thus killing the microbes they contain. About the best thing to do is for the operator to carry a brush hook, since he may have to hew his way to where he wants to go. He thus also has a weapon in case he encounters a dangerous animal.

In 1916 this disease was known to be present in New Hampshire, Vermont, Massachusetts, Connecticut, New York and Pennsylvania. It had also been found previously in New Jersey, Ohio and Indiana. Probably the trees known to be infected were there destroyed and the disease was considered to have been exterminated. "Imported white pines of suspicious origin are known to have been shipped as far west as Illinois and Minnesota, but not beyond the natural range of the eastern white pine." What a nice little job it would be to grub out all the currants and gooseberries west to Minnesota as a matter of supposed insurance and precaution! "The white pine, in many sections

at least, is much the most valuable tree now available for future forests. Its loss would be a real catastrophe, for no other tree can take its place." (Bull. No. 742, p. 6)

Which shows that public interest requires that I be given a square deal, have the Department of Agriculture admit that I am right, or else show what is wrong.

Using a hot air blast torch to control rust on currants and gooseberries is only one of the many uses to which heat thus generated can be put, described at length in my Circulars No. 130 to 147. For instance, the Eastern States are now becoming heavily infested by the pearthrips. I had shown to the Bureau of Entomology in my Circular No. 147 that torches of any type needed can be readily constructed, and that heat applied while the pearthrips are in the larval stage will cause them to drop, and they can then be killed by applying more heat to the ground. Where the insects do not drop, as is the case with scales and lice, repeated slight swift lickings will keep them down, and at far less cost than any other known means. This also always destroys the spores of fungi that are present. I had also shown in my Circulars No. 139 to 147 how insects can be trapped in large numbers with the type of torch shown, properly fitted up. For instance, while nutweevils spend the winter in the ground, and should be kept down by poultry and hogs, adults might appear in alarming numbers. Practically all these fly to lights and could be trapped. The pine weevil, which eats out the apical shoot, is a similar case

In my Circulars No. 148 to 151 purposely very little has been said about this use of a torch as a trap, or about a still better and much needed system of trapping I could describe. There is nothing for me in any mechanical device as long as the the U. S. Entomologist is permitted to claim I am wrong on every point without being compelled to show where the wrong comes in.

So beginning with Circular No. 148 I began to work out a detailed system of control for insects where no apparatus is needed. These include the range caterpillar, the boll weevil,

the bollworm, the Argentine ant and the gipsy- and browntail moths, taken as farm and forest pests.

The range caterpillar, for instance, does most of its damage within North-Eastern New Mexico. Thus here we have a more or less localized trouble. If it is not feasible to interest the State Authorities, the Members of Congress and the People, I simply bide my time. I tried to get Mr. Wildermuth, who wrote U. S. D. A. Bullentin No. 443, treating on the range caterpillar, to state his side. There was no reply.

Texas is now up against a similar proposition. Newspaper reports have announced the discovery of the pink bollworm in 5 counties about Galveston, claimed to have come from the Laguna district in Mexico. "Congress appropriated \$250,000 for the fight and the State of Texas also put up money. The next step will probably be the creation of a wide zone in Texas where cultivation of cotton will be forbidden for a number of years."

Under date of Aug. 7, 1914, the Department of Agriculture issued a Circular giving general information about the pink bollworm, but refrained from suggesting any means of control. According to that Circular the pink bollworm cannot be starved out through failure to plant cotton. On page five of it you can read: "Occasionally the pink bollworm appears to attack other plants" (than cotton)...

I tried to learn through the Bureau of Plant Industry what plants we might have in this country closely related to these food plants. My request was referred to the Bureau of Entomology and Chief Howard stated: "The records which you mention of other food plants of the pink bollworm have been proven by recent investigation to be erroneous. The only normal food of the worm is cotton."

That is, cotton, as far as is known. If so, it is theoretically possible to stamp the insect out by growing no cotton in the infested area. Anyway, adopting the use of poultry and of trap-patches for the control of the boll weevil and the bollworm outside of this area is the best precautionary measure now known

against the spread of this insect should it occur beyond what is believed to be the infested area.

From what has been published on the life history of this insect it may be assumed it has at least three generations a year. "First a considerable number of squares and bolls are so injured that they fall to the ground. In case of heavy infestation 50 per cent of the crop may be destroyed in this way... A single lock of a boll may be infested. In such a case the remaining locks develop, but the boll opens prematurely and the fibre is short and kinky... Moreover the work of the insect leaves stains in the fibre... Mills ordinarily obtain from 19 to 20% of oil, the amount...was found...reduced to from 16 to 17%... In many cases the infestation must be so high that at least double the usual quantity of cotton seed must be used to secure a stand." (p. 4)

The insect seems to pass the winter as larva and pupa in cotton seed exclusively, although "pupa have sometimes been found in the lint." (p. 6) Thus the insect can be attacked by utilizing the seed not wanted for planting before emergence takes place, or else, the seed has to be sacked or kept in a screened room to avoid the escape of the moths. There seems to be difficulty to separate the infested seed from the uninfested.

All in all the means of control described by me for the control of the boll weevil seem to fit this new comer to a dot. The fallen squares and young bolls, of course, can be attacked in no other way than by poultry. Given the choice, there is every reason to believe that later in the season they would forsake the old plants to oviposit on the trap-patch advocated for the control of the boll weevil and the bollworm.

There is a strong suspicion that if it were attempted to control the insects by early destruction of the plants, it would readily learn to feed and breed in plants other than cotton. The adults during the whole season will during the day time be hiding about the plants, and many will be found by poultry. In addition, if further means of control were necessary, it is highly

probable that this insect can be easily trapped by the use of a torch fitted as a trap, as described by me in short on pages 7 & 8 of my Circular No. 151.

In my Circular No. 139 and subsequent Circulars, I had shown from official tests and tests made by myself that the codling moth is but little attracted by light, if the light is diffused through an opaque globe and is thus diffused pretty evenly all over a room, and that on the other hand the codling moth is strongly attracted to light that is thrown upon spots, as happens in case a common lamp has a stiff paper shade and throws its light upon a table and leaves the rest of the room in darkness. Spiders, flies and mosquitoes cannot be said to be attracted to light, yet I have repeatedly known them to make their way to light under the latter conditions. The Entomologist was wanted for five years past to test this point out to his heart's content. Having done nothing, he now wants to claim I am wrong.

In using a torch for a trap the insects are originally in darkness without, and can only come to the light by entering between two corresponding cone-shaped attachments about an inch and a half apart and encircling the red hot burner. The narrow quarters within causes the insect to bump against the red hot burner and against the cone-shaped attachments, becoming thus temporarily disabled. This causes them to drop and thus fall through a hole in the center of the lower attachment into a pail below, to get killed by the downward blast from the torch.

The entomologist's idea of trapping consists in placing pans with water and kerosene near electric lights. Utterly impracticable as this was shown to be on page 7 of my Circular No. 151 a catch of any kind would thus be quite accidental. In a cotton field for the bollworm moth a large pan with a lantern set on bricks is the method that has been used in tests by Entomologists. A few moths were thus caught. The wonder is that any were caught. In the first place the light in this case is diffused over too great an area offering no special inducement to come

close by or to sit down on the water and kerosene. Then again, if a bollworm moth accidentally sits down upon the water, being a strong bodied moth, it is liable to get away. This holds good especially with the hard bodied kinds which are not immediately affected by the kerosene.

There is urgent need for the introduction of a trap that traps. The female of the European pine shoot moth for instance lays her 100 eggs singly in the top buds of the shoots, selecting as far as practicable the apical cluster of buds on young trees. I had shown that on young trees these apical buds can be protected by pouring some semi-liquid clay over them before the period of ovipositing begins. This of course, is purely a repellent measure. To secure material reduction of the insect the only feasible means is the use of a trap that traps, such as described by me. In this case there is utilized for a trap an apparatus intended to be used during the day for other work.

The European pine-shoot moth was introduced during the same period and through the same importation which brought in the disease known as white pine blister rust. Naturally it is spread over much the same territory.

As to natural enemies of the pine shoot moth "As early as 1838 Hartig recorded 14 ichneumonid wasps and a tachined fly.. to promote the good work of these parasites specially constructed rearing houses have been created in Europe during bad outbreaks..." (U. S. D. A. Bull. No. 170, p. 9.) This shows that to encourage the increase of parasites is nothing new. In spite of this work, however, and of collecting infested shoots as a regular measure, "75 acres of young pines planted in 1878 became infested to such an extent that hardly a shoot was spared, and in 1884 the entire plantation presented a pitiful, crippled appearance." (p. 3.) "The species attacks mainly young trees between 6 and 15 years of age, but it is often excessively destructive to younger plantings and seedlings and injures also the other trees. (page 3.)

Thus it will be seen that protection of the apical bud by an application of semi-liquid clay is quite feasible in a very large part of cases. Since these same trees are even then preferred for oviposition, by operating a satisfactory trap in such plantings the number of moths can be greatly reduced. All this and more was described originally in my Circular No. 145, in 1915.

Farmers' Bulletin No. 856 has recently appeared. It treats on the diseases and insect enemies of the home vegetable garden. On page 35, relative to the control of the harlequin cabbage bug you read: "...The plumber's torch is effective for this pest, destroying all the insects with which the flame comes in contact... These torches are not practical against many other insects and their use should be restricted to this species and a few others."

I was first, in 1898 to point out the use of a plumber's torch against this insect. I also at that same time showed that the adults congregate upon tassels of sweet corn, hence can be picked off there, with the torch, or by hand. I also then showed that the flame and heat generated by the torch is the most practical means of control in many other cases. For instance I showed it to be of great value against the chinch bug. According to Entomology Bulletin No. 95, part 3, page 38, the Bureau now claims: "The flaming torch is not altogether satisfactory on account of the liability of damaging the plants..." Ask them what other means they have and they tell you: "The burning of grasses and rubbish about the farm to destroy chinch bugs has been often recommended and is doubtless the most effective measure to be taken against future ravages of the pest." (p. 36)

Any one familiar with chinch bug emergence in the spring knows of the countless billions of winged adults that drift about during warm spells in April and May. They come not only from "grasses and rubbish about the farm," but from woodlands as well, nothing to say about buildings. Such burning, in a few years, destroys most of the fertility and ruins the farm by erosion. Moreover this burning may bring no practical results, because the next spring and summer might be warm and moist

and thus reduce the pest through the developement of parasitic fungi.

Other means of combating chinch bugs, as given by the Bureau, are dust barriers, coal tar barriers and kerosene emulsion. All of these admittedly, have their drawbacks. Two points, called attention to by me as early as 1898, have been entirely ignored. They refer to the habit of the chinch bug to go into the ground during cool nights and cold days. Also that the torch should be used preferably during the cool parts of the day, especially in the cool part of the morning while the dew is on. In the case of chinch bugs traveling from harvested small-grain fields to corn, and there clustering on the outer rows, there is nothing to prevent the use of the torch during all of the night, this the more as at this period the nights are usually warm enough to prevent any great number of bugs to seek the protection of clods about the plants. During a cold spell all the bugs will be hidden under the clods and a torch approaching and playing about the base of the plant gets them all without any injury whatever to the plant.

I showed in 1898 that this holds good with many other insects and pronouncedly so with most of the cucurbit insects, showing that by carefully lifting a vine, especially in the early morning and letting a blast blow on the ground about the plant, the ground becomes usually at once fairly alive with insects.

Later I showed that by mulching all or part of the plants with half-rotted manure especially inviting hiding places are furnished. I also showed that the foliage of cucurbits sustains a surprising amount of heat without injury, facilitating greatly the destruction of insects on the leaves, such as young squash-bugs or lice, located on the under side of the leaves. I also as early as that showed that such use of flame and heat destroys the spores of fungi with equal facility on the upper and lower side.

Later, in my Circular No. 139 and subsequent Circulars I showed specifically that flea beetles are best attacked by taking advantage of their habit to spend the night under clods on the

ground, laying special emphasis on the need of making use of this feature in the control of the hopflea beetle on the Pacific coast.

In Entomology Bulletin No. 82, part IV, p. 42 you read: "The (hop flea) beetles go into the bud scales or down under the clods at the base of the vine on cold nights, but when mild weather approaches they remain on the leaves.," And in No. 66, part VI, p. 74 the manager of a large hop yard in British Columbia says: "...In the middle of July the beetles were so numerous that the ground was fairly alive with them. They go into the ground in the evening and come out again in the morning..."

There are two broods in British Columbia, the first emerging during the end of April and first half of May. Naturally the thing to do is to go after this brood, since the nights are then cool and the pest can be cleaned out with the torch with the greatest ease, if necessary doing part of the work during the night.

Compared with this the Bureau has nothing to offer that in any way approaches these results. And the same holds good in a general way, in the case of all other flea beetles, with all lice and mealy bugs on growing crops, in fact with any insect requiring a contact insecticide or not readily amendable to the use of poison, such as is the cabbage worm and potato beetle (bug).

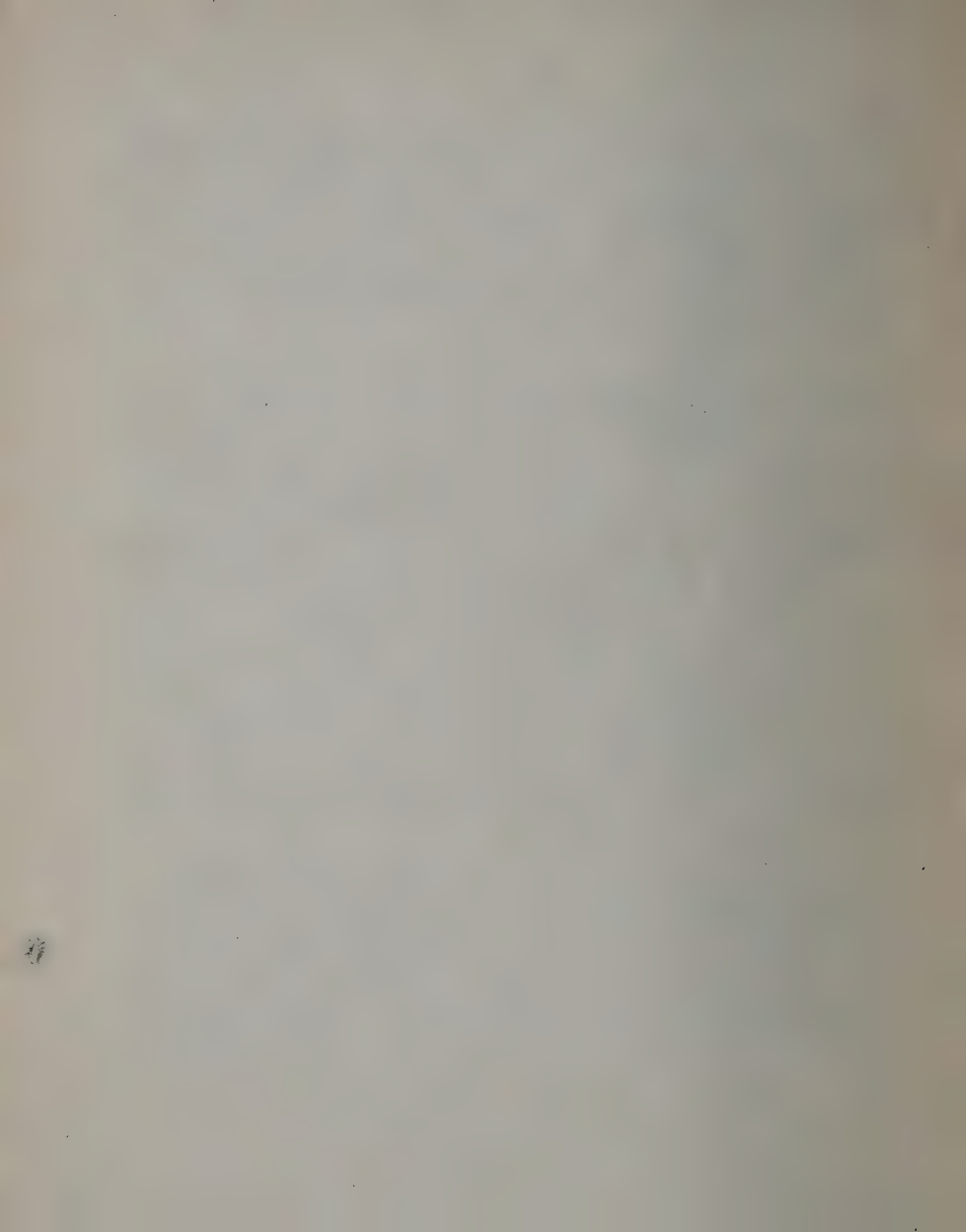
In the case of the harlequin bug I had since shown that since the harlequin bug lays her eggs on a variety of cruciferous plants, wild and cultivated, and selects the underside of the leaves, the immature insects can usually not be seen without turning the leaves by hand, and I showed that far the easiest way of control consists in seeing to it to have during all the season some cruciferous in bloom. The pollen then attracts the adults and being in plain sight, they can be picked off by hand, with a torch, or by the use of poultry.

Of course the plumbers torch is not by any means the most practical kind of torch that can be used. A torch of the knap-

sack type as shown on last page is the best thing all around. The onion thrips for instance is very destructive to onions, cabbage and many other crops, the insect being capable of 6 or more generations in a season. It can best be attacked by having a blast blow along the row upon the ground, The insects while in the nymphal stage are very susceptible and unable to get away except by dropping to the ground, which however makes it possible to destroy the pest without applying much heat to the plant itself.

An insect of greatest importance where the use of heat is far the best means in sight is the pear thrips. In my Circular No. 147, and elsewhere, I went into details showing that there is no difficulty to construct torches to treat big orchard trees. I showed on page 12 that the practicability of this system rests upon the fact that five gallons of gasoline will keep four burners going 20 hours under a pressure of 30 to 40 pounds. There is nothing in the way of a spray, except where poison can be used to advantage, that approaches heat thus generated and applied, as an insect killing agent for cheapness, where a contact insecticide is required. Canker worms or brown tail moth caterpillars, for instance, might be present. These are practically immune to poison, while the use of a torch settles both these and the pear thrips. A slight licking makes them fall to the ground where they are killed by further application of heat. This insect has a wide range of food plants, wild and cultivated, and because of this requires an easy means of control to be successfully combated.

Hooverize! Hooverize is the cry! Hooverize is the official cry! We have the meatless day and the wheatless day, but why can we not have the humbugless day seven days in the week? Have the Congressional Committee on Agriculture take up the issues at question and you increase output of food by more than a ship load a week, by avoiding waste caused by insects and fungi, representing a value of more than a billion dollars a year.



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no. 153

On the Control of
Cucurbit Insects
and of Fruit Flies.

By Fred Reinlein

1751 Derby Street

PORTLAND, OREGON.

Circular No. 153.

Dec. 16, 1918.

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Farmers' Bulletin No. 914 has recently appeared under the heading of "Control of the Melon Aphis." The insect in question, however, has for natural food plants cucurbits, cotton, okra, and citrus fruits. Its economic importance is thus summed up on page 5: "It is, indeed, a pest of the highest importance, and, taken season after season, the most destructive aphis occurring in this country."

The means of control as given on page 16 consists in beginning to spray as soon as infestation is found, and of using plenty of spray—200 gallons to the acre, if necessary. For apparatus to do this with is shown a handsprayer of the compressed air type, and also a traction sprayer. It is obvious that the use of the first means slow and expensive work. The second is claimed to provide at a pressure of 150 lbs. a spray that will move the leaves about in such a manner that both the under and upper surface become thoroughly wet by the spray. It is evident that as long as the vines do not cover the ground, a great deal of the spray is necessarily wasted under this method. Not only this, but the insects feed on the lower surface of the leaves, hence wetting the upper surface is of no value; besides the leaves are often badly curled after infestation has been allowed to become heavy, thus practically preventing the effective use of sprays.

The insect hibernates on weeds and other food plants. "The great numbers of this species sometimes suddenly discovered on melons, cotton, orange and other plants are often the result of enforced emigration on account of the death of other food plants in the vicinity..." Thus the question is, what do you do when partly grown cotton, cucurbits or citruses become thus suddenly infested? The nearest approach to success of the means advocated by the Bureau would be the use of a power sprayer, fitting the particular requirements of the case.

Taking melons for an example, these and other cucurbits, in common with other plants, are affected by a large variety of insects, against many of which, present at the same time, the use of a spray, as described, would be of little or no value. The prin-

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principal ones are the squash bug and the striped cucumber beetle. Then there is the squash vine-borer on squashes, melons and other cucurbits. Sprays do not affect this insect. In Farmers' Bulletin No. 668 Dr. Chittenden, in charge of truck crop insect investigations, after mentioning as means of control the planting of early squashes as a trap-crop, fall harrowing and deep spring plowing, covering bases of plants with earth as infestation takes place and cutting out the borers, says as to capturing the moths: "This species may be held in partial subjection by keeping a sharp lookout for the parent moths which are readily seen and not difficult of capture towards dusk or in the cool of the morning, when they are comparatively inactive. The female may then be easily caught just as she alights upon a vine for oviposition." In other words, all the means advocated are slow and cumbersome. However capturing the moths, done the proper way, a way shown by me as long as 20 years ago—is probably the best single means of control.

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It will be readily seen that a moth that is active during the day, and is found towards dusk or in the cool of the morning near its food plant, spends the night hidden about the plant. The means of control for such insects I had pointed out as far as 20 years ago. It was the use of a hot air blast torch. The vines were to be lifted or moved slightly, and the blast to be allowed to blow upon the ground and through the leaves. Later I got out a torch of the knapsack type, as shown on last page. With an apparatus of this kind one can apply the heat by swaying the burner with one hand, and with a stick in the other hand, one can lift or move the vines sufficiently to allow of effective application of the heat. The deflection of the heat waves from the ground to the leaves readily kills soft bodied insects upon cucurbits, such as young squash-bugs or aphids. And the heat waves find their way to aphids in partly closed leaves more readily than anything else that can be used. Of course, there should not and need not be any curled up leaves; start the blast in time to prevent that. Its use is cheap, and there are always also other insects present that should be secured. For instance regard-

ing large sucking bugs in their last two stages as in the case of the squash-bug or the harlequin cabbage bug, Dr. Chittenden says on page 11 that they are "very difficult to destroy with any form of contact or other insecticide." The fact is that the use of a blast readily kills them. That this is so in the case of the harlequin bug has been now admitted by the Bureau of Entomology for a good many years, but they have always refused to admit that I was the first to describe this plan.

The various cucurbit insects involved as the blast is allowed to play upon the ground, especially along the line where just the vine has been moved, will be found hidden, and they will start to run, can thus be readily seen and can be killed by holding the blast close up to them for a second or two. I had pointed out that the number of insects thus becoming noticeable is astonishingly large and varied, The striped cucumber beetle, for instance, is thus readily gotten rid of. It is not at all readily amenable to the use of poison, the remedy recommended by the Bureau.

However this beetle is now suspected of carrying and spreading the bacterial wilt and the mosaic disease of cucumbers. On page 15 of his report for 1917 the U. S. Entomologist says that Bordeaux' mixture used to control these or other diseases acted strongly as a repellent where poisoning of the beetles was desired. "On trap crops 98 per cent of the beetles were destroyed with the crude oil soon after their emergence." To use trap crops presupposes that cucumbers be planted a month or two later than they could be planted normally. But why use trap crops? This insect feeds also on plants other than cucurbits, hence without trap crops the effect on late planting is substantially the same, since they may go to cucurbits or other plants elsewhere. It all shows how hard the insect is to kill under present official methods.

These striped cucumber beetles, and also the adult squash bugs and the squash vine borer are all present early in the season before aphids would become at all plentiful, hence using a hot air blast against them thus incidentally licks off the few aphids

that appear quite scatteringly early to act as stemmothers. This thus saves the slow, troublesome, expensive sprays of nicotine sulphate, soaps or kerosene emulsions. Of these kerosene emulsion applied during the day is apt to prove quite injurious. Used against thrips on tobacco in Florida it was found necessary to use it at night.

On page 1 Dr. Chittenden shows a man lifting the vine and another doing the spraying from a compressed air hand sprayer, a slow, disagreeable and expensive job. Moreover handling the vines as shown is considered to be quite detrimental to rapid growth by all growers. The use of a blast with a stick to slightly lift and move the vines permits of efficient application of the blast, and the method costs only about one-twentieth of the other and also permits of killing at the same time most of the other insects, biting or sucking. Further, I had shown that cucurbits readily stand the blast, whereas they are easily injured by a spray. The blast also destroys the spores of fungi which are becoming highly troublesome to cucurbits.

As usual natural enemies come in for consideration. "There is perhaps no better example among insects of a common and wide-spread species held in abeyance and limited to innoxious numbers, save in exceptional seasons, by natural enemies, than is the melon aphid. The usefulness of these natural enemies, of which a large number have been recorded in subduing the plant-lice, cannot be over-estimated..." (p 8.)

This is all very well, but judging from what Dr. Chittenden says under 'Cultural Methods', there is no place for them to hibernate. "...All weeds in the vicinity should be kept down throughout the year, including late fall and early spring, since, as has been shown, the common weeds of the field and garden are available as food plants and serve as the hibernating quarters of the melon aphid..." (p 15).

Just how this little job is to be done, the Entomologists of late years have become shy of explaining, but it is manifest that burning would offer the only feasible way, supplemented where necessary by plowing, hoeing or spading. The whole thing is

absurd, because even then the aphids could hibernate in meadows and pastures, none of which should be too closely cropped for best all around results. As for weeds and grasses along ditches, river banks and terraces, these are needed to hold the soil in place. And the steeper the land is the more necessary becomes a heavy stand of grass, weeds, brush or timber to prevent erosion. "In some sections of the United States, particularly in the South, erosion is assisted materially by the alternate freezing and thawing of saturated soil. The freezing process upheaves a thin layer of the soil near the surface. As this layer of loosened soil thaws, it settles, with a tendency to slightly move down the slope. It is very common for heavy rains to occur directly after the thawing period and wash away the loosened soil from the surface of the field." (bearing no cover crop). "Probably no other combination of natural conditions could operate more effectively to rob a field of its most fertile soil in the same period of time." (D. A. Bulletin No. 512, p 3: Prevention of Erosion of Farmlands by Terracing.) Of course where there is too much slope for the land to be used as a field, it is all the worse. "The carrying power of water varies as the sixth power of its velocity." [Y. B. Separate 688, pl 10: Farms, Forests and Erosion. Send for a copy. These near-sighted Entomologists do their best to turn the country into waste land.]

Weeds adjoining cultivated lands and infested by aphids and other insects, provide a breeding ground for natural enemies, hence, as a rule, such weeds should be left undisturbed, anyway when you have a ready means of control on the crop itself by means of a torch. "When the aphid is found, do not wait to find out whether it is going to increase, but begin spraying at once." [Farm Bull, No. 614, p 14] Just why a slight licking with a hot air blast torch should not be vastly better and cheaper, they have never attempted to show. The only test they made was a cabbage that had been allowed to become incrustated with lice, and then they claimed they could not rid the plant without hurting it. They were wanted to show what else they could use then to rid such a plant of the lice, with or without hurting it. As a matter

of fact it is possible to rid a field of cabbage thus incrustured by the use of a hot air blast torch, and this without causing any injury. This can be done by going over the field, provided the plants possess as yet a fair degree vitality, twice a day as long as necessary, giving each plant a swift licking at the time, This should be done morning and evening, or during the night, while the due is on.

In my Circular No. 147 I had shown at length how torches to meet any emergency can be constructed. Thus, to treat lice, scales, thrips and spores of fungi, on tall forest trees, a tower might be fitted to a wagon gear, this tower to carry a supply of gasoline under pressure, at a suitable elevation, and permitting of reaching any part of the tree with a blast, It would be better, especially where tall trees are to be treated, to carry the gasoline tank at the foot of the tower, have a pipe lead to or above the height desired to be sprayed, and then from this point have a pipe drop down to the bottom of the tank again. This would furnish an even flow of gasoline to the highest point to be reached. without raising much weight above the axles of the wagon and thus endangering the balance on rough ground.

This use of a hot air blast torch is far better and cheaper than the other means now employed. For instance a tree at the time of the breaking of the buds might carry numbers of aphids. These could be killed cheaper by the use of a blast than by any other means. Since spores of fungi are present, the blast destroys these also, whereas otherwise a special fungicide must be provided. Incidentally rains do not interfere with the effect of the blast.

Suppose pearthripes are present. These require, under present official methods, the use of nicotine sulphate much more thoroughly applied than would be necessary for the control of the aphids. A slight, swift blast, repeatedly applied, will do the work of killing the adults cheaper and better than could a spray, but a still better way, when the adults in early spring are not too numerous, consists in giving the tree some slight lickings some weeks later when the insect is present as larva. These then upon feeling the blast drop, and can then be killed on the ground

by the use of more heat Cankerworms, or the larva of the brown-tail moth might be present at the time of the swelling of the buds. But these worms are very resistant to poison and usually manage to keep down the foliage so there is nothing to carry the poison. Because of this, it is now advised officially, where considerable browntail moths are present to deposit eggs during July, to spray the forest trees by the middle of August with a solution of 3 to 5 pounds of arsenate of lead to 80 gallons of water. You will readily see that in the case of apples it could not well be avoided that dangerous quantities of poison accumulate in the stamens of the fruit,

The use of a torch will also render harmless on fruit trees the presence mummified fruits and of cankers. Merely holding the torch close on to the mummified fruits or allowing it to lick into the cracks of the cankers repeatedly during the growing season will destroy the spores, stop the progress of the disease there and will enable the canker to heal over.

I had also shown that it is possible to use most of the parts of a given apparatus to construct some other type of apparatus for other kinds of work. Apparatus to apply heat to grain, forage or truck crops as needed, can be constructed largely out of parts of apparatus that may not then be needed for orchard work.

I had pointed out throughout my Circulars No. 147 to 151 that it would be always to advantage to have poultry present to pick up the insects that drop and that are of sufficient size so they can be found.

However the country is now being threatened with the introduction of two new pests of greatest importance against which now no satisfactory means of control are known other than that I showed on pages 17 to 19 of Circular No. 151, that poultry could be used to pick on fallen fruits and search for pupae of the Mediterranean fruit fly, which is one of the pests in question. The other is the melon fly, both present in enormous numbers in the Hawaii Islands, and the former also in Bermuda.

I shall show that by the judicious use of stock, especially

of poultry, in connection with a judicious use of unpoisoned baits, the pests can be readily controlled.

A species related to these is the native apple maggot. As this species has been closely studied, I shall first show what investigations have shown in regard to practicable means of its control. One of the most detailed studies is given in New Hampshire Experiment Station Bulletin No. 171. The most practical means of control found is shown there to be the careful picking up of the fallen fruits. It is obvious that stock might be utilized to secure all or part of the drops. Pigs, sheep, cattle and poultry are mentioned as stock that can be used. Cattle would certainly need watching. Horses would need less watching than cattle. As both of them are liable to eat apples off the trees, they would be of value chiefly by eating up fruit on uncultivated areas. In orchards sheep, goats and hogs with poultry, will be best. Hogs are stated too often injure the trees. The consensus from reports on this point is, that they injure the trees only when confined too closely, and that otherwise they are markedly beneficial. "Given plenty of run, and enough to eat and drink and they will not bark trees." (p, 106)

"Poultry are not able to dispose of infestation by the maggot unless large numbers are confined to a limited area. Apparently about 500 hens to an acre are required, depending on the size of the trees" (p106), Mr. O'Kane, the author, here evidently speaks about the possible value of poultry by attacking the larvae in the fallen fruit. Of course, not much can be expected of poultry along this line. To eat up the fruit, other stock, possessing teeth, must be used, hogs with their ability to root for grubs being best.

"It is believed in the light of some experiments described below that a considerable part of the value of poultry may lie in their ability to find and destroy pupae in the soil, and to a less extent, probably, their ability to catch and eat newly emerging flies" [p 106]. Here we have quite a different aspect of the matter.

"Pupation... takes place after the fruit has fallen from the

trees. If the larva has not come out at a point near to, or in contact, with the soil, it makes its way over the surface of the fruit." [p 81]. That is, the larva preferably buries beneath the fallen fruit. In that case the mere moving of the fruit by poultry—all rasorial birds—would often disclose the larva or pupae in full view, or anyway only an inch or so below damp, loose soil, that is easily picked.

On pages 107 and 108 Mr. O'Kane gives the results of certain burial experiments to test the ability of poultry to find pupa of the apple maggot. In one series of tests with 100 pupa each buried two inches deep in 3 cages September 12, with one hen to a cage, no pupae could be found in the first cage after 3 days. 2 pupae were found in the second cage after 7 days, and 7 pupae were found in the third cage after 10 days.

"Examination of sod beneath infested trees showed pupae present not far from the surface of the soil among the upper grass roots. Examination of cultivated ground disclosed pupae in greatest abundance at depths of one to two inches." [p 82]

"The duration of the pupal stage, in the case of individuals that complete their life-round in one year, apparently approximates 300 days." (p 83) Thus here we have the pupa exposed to possible attack by poultry for 10 months out of 12.

As the apple maggot breeds in wild pome fruits, including huckleberries and blue berries, it is obvious that pasturing with stock wild lands where these food plants occur is necessary, for such or similar vegetation is necessary to avoid erosion, especially on slopes. To substitute some other kind of trees, nut trees for instance, or keep the land in grass, would not help matters as a whole. The other trees or grasses have their insect- and fungus enemies also. Nut trees, for instance, chiefly suffer from weevils. The Bureau, in Entomology Circular No. 96, p 11, decries the grafting of cultivated varieties of chestnuts on native chestnuts growing on rocky, uneven soil, says, it is imperative to plant on smooth ground, says, the collection of remnants can be made by children or the unemployed. All the farmer has to is to make this proposition work. "It is also profitable to allow

hogs the run of the orchards to destroy what nuts remain after the crop has been harvested" (p 12). Just as if they could not equally destroy the nuts on hilly land. "Hogs fatten on nuts and acorns," and also on a combination of pome fruits, stone fruits and grubs, "as well as on corn and without expense to grower." Then why not encourage wild chestnuts, chinquapins, pecans, hickories and chestnuts to clothe the hill-sides, even if they serve no other purpose than to secure timber and hog-feed? There is nothing better than hogs while there are nuts to pick up, with poultry on the ground while these weevils are present as larvae, pupae or adults in or on the ground. This then makes stock raising and fruit raising go hand in hand. Moreover this course by encouraging dense vegetation does more to encourage the development of wild bird life than all other means man can employ.

Tests with poison sprays against the adult apple maggot fly showed that nothing can be expected from a poison spray. Tests with poison trappans showed: "They had caught a large and heterogeneous mass of insect life. A part of this material was gone over, but no traces of the adults of the maggots were discovered." That simply shows that trapping with pans, or, a better way, with a torch as described by me in my Circulars No, 147 to 151, can be used successfully only along with a knowledge of what is being trapped, involving education of the public along this line. I have had in mind for several years the working out of several apparently sound ideas along this line, but, as this involves the use of much time, funds and financial risk, if the representatives of the public are not in a hurry about having the issues pending settled, I am even less in a hurry to take up such a matter.

On the manner of emergence of flies you read on page 44: "At various times, from June 29 to July 6, 1911, observations were made of the behavior of flies on emergence from the ground. On first coming to the surface flies are vigorous and active... the wings are not expanded. For a time they crawl around rapidly, seemingly searching for a suitable place for expanding and drying

the wings. Occasionally one will jump, somewhat like a spider.. The length of time required for the wings to expand and dry varies from 43 minutes to an hour... The flies did not attain the normal dark color until about an hour after the wings were expanded and flight was not much indulged in until this additional period was over. Thus the total length of time from the first appearance above ground to active, normal flight was an hour and a half or more." That means then that there is a good chance for poultry to catch the newly emerged flies, allowing that after that the flies are out of reach.

Emergence in New Hampshire is given as to extent from end of June to middle of August. "The flies normally emerge in largest numbers in the second and third weeks in July" (p 56). Thus keeping poultry in the orchard during this period should result in a material lessening of what adults survive to lay eggs. There is a possibility that the adults spend the nights, or days and nights, during cold windy spells, under vegetation or clods on the ground. In that case this would further expose them to attack by poultry. "Perhaps the most notable characteristic of the adult flies is their sluggish behavior. They are not normally active or nervous.." (p 59),

As to the period of time before egg-laying begins, you read on page 45: "...it is certain that the period may be thus brief" [4, 6, 8 days respectively] "on occasion and that the two to three weeks hitherto assumed as the approximate minimum does not always prevail,"

"If fruit of attractive qualities is at hand, the flies are localized in their habits.." [p 90] "...the flies prefer sweet or aromatic fruit... So long as such fruit is available the females will continue to oviposit in it until individual apples may be fairly peppered with egg punctures..." (p 49) "The flies feed rather sparingly..." (p 57)

"In no case were flies ever observed laying eggs in apples that had dropped from the tree. In normal surroundings flies were never seen on or near the ground, except at the time when they were emerging" (p 52).

"That hogs are fond of apples is well known to any farmer. Sweet fruit, which chances to be the kind often badly infested by the maggot, is especially relished" (p 104). Hence having enough stock to eat up the drops, and a good supply of poultry in addition to search for pupae of this pest and orchard pests in general, will control this pest in a practical manner, provided the wild vegetation is also being kept clear by stock.

Naturally the life history and food habits of other fruit flies are similar.

Judging from the frequency the Bureau of Entomology is referring to the melon fly and the Mediterranean fruit fly of late they seem to suspect that the pests are already established on the Mainland U. S. or at least that an infestation is apt to be discovered at any time. To find a needle in a hay stack is easy compared with finding the first actual infestation of such an insect.

Under the present quarantine regulations, as applying to these pests in Hawaii, bananas and pineapples, in proper condition, is permitted to be shipped to mainland United States, but it is conceded (D. A. Bull. 640 p. 34) that the packing material, in spite of careful inspection, might contain pupae. The regulations provide for fumigation of the crates upon arrival. This is done by throwing tarpaulins over a stack of crates. Wind might be blowing and the side exposed to the wind might not get the necessary amount of gas. Besides there is nothing to prevent an adult developed from a pupa in transit to escape through a crack before the crate can be fumigated. Also "...Passengers and ships are permitted to take on board in Hawaii fruits of all descriptions for consumption while enroute to the coast. All contraband fruits, however, must be eaten or destroyed before the ship comes within the 3 mile limit of the mainland..." (p 42). Thus there is no end of chances that a larva of either kind have left an infested fruit, pupated out of sight, and escaped to the mainland upon the arrival of the ship. In addition "quarantine officials have found the pest in fruit concealed by tourists, and in mail and express

packages..." (p 43). Thus it is practically impossible to keep the pest out, and the thing to do is to be ready with proper means of control. Just for a comparison: In the case of the gipsy-moth the scattering of the first colony, by a wind storm had been brought to the notice of the authorities. The pest was considered to have been exterminated, simply to turn up 20 years later in great strength. In the case of the pests in question, the difficulties are many times greater.

Regarding the melon fly we know: 'All the cucurbitaceous plants are subject to severe infestation, particularly of the young fruits. Cantaloupes are the most susceptible, since the vines as well as the fruit are attacked badly at all stages of growth...' [D. A. Bull. 643, p 17]. "As many as 650 adults have been reared from a pumpkin not more than 4 inches long; the staminate bloom while still a bud may support as many as 37 well grown larvae" [p 20]. "The usual custom... is to permit infested fruits to decay in the field. In certain uncultivated areas the wild sycos and Chinese cucumber run wild and furnish fruits in which the melon fly can breed throughout the year ." [p 26].

One parasite has been introduced and more work along this has been attempted, which is well enough, as far as it goes. Naturally other means of control should be such as not to interfere with the development of these parasites. Of artificial means of control there is proposed, 1. the destruction of the eggs and larvae by submerging infested fruits in water or by boiling, and 2, the destruction of the adults by spraying [p 26]. Neither has been found to be practicable and protective covering "with soil, paper or cloth, is the only method that will protect under present Hawaiian conditions" [p 28].

With cucurbits growing the year around and some of them growing wild and the pest living also upon the tomatoe, beans, cow-peas, orange, peach, papaya, fig, mango and others, it is obvious that any system aiming at the control of any insect that in Hawaii has 8-11 generations a year is worthless, unless it makes it feasible to minimize the development of adults from

wild vegetation. As to the use of a poison spray you find explained on page 27, that tests along this line could not be carried out so that sound fruit was secured. because of the constant influx of females. However "within 24 hours many dead adults could be found among the vines." Nothing was said why the parasites should not also feed upon the poison and be destroyed. However it is claimed: "Honey bees are not endangered by the application of poisoned bait sprays" [D. A. Bull 640, p 36].

"One female fly lived from February 17, 1914 to April 4, 1915 or 13½ months;;; Female flies may begin to lay eggs as soon as 14 days after they emerge from the pupae during the warmer months...[p 23] during the winter... many adults may not lay until 44 days after emergence;;; 1000 eggs probably may be laid by vigorous, long-lived flies, one fly;;; laid no eggs in fruit until she was 51 days old" [p 24]. "...adult melon flies... feed continuously throughout this period..." (p 27).

I shall give later evidence to show why it should be possible by the judicious use of poultry in connection with unpoisoned baits to greatly reduce the number of the adults before they can lay eggs.

";;;The larva when full grown leave the host to transform to the pupa stage just beneath the surface of the soil, or beneath any protecting object..." [p 4]. "The melon fly does not confine its attacks to the fruits of its host or food plants. It may attack the young seedling, the flower, the root, the stem or the fruit" [p 8]. So persistent is attack upon cantaloupe in Hawaii that the vine cannot be grown satisfactorily except in isolated spots or under cover" (p 10). "The larvae seldom get far from the point of emergence... under usual conditions they enter the soil to pupate directly beneath the host fruit.... Pupation occurs,... rarely deeper than from 1 to 1½ inches"(D. A. Bull. 491, p 40)

• Poultry are therefore able to secure readily a large per centage of the pupae thus hidden. Very little damage from poultry need be feared because of their hunt for pupae. They would have to be kept out of young plantings and must have plenty of room. This work of securing pupae must be considered to be only aux-

iliary to securing the adults on suitable unpoisoned baits.. Poultry cannot be used where they would pick on uninfested fruits. it comes into play chiefly where all or most of the good fruits have been gathered. Infested fruits, instead of being boiled or buried, and both these ways offer serious obstacles, could be thrown into an enclosure to be eaten up by hogs, with poultry picking for larvae and pupae. This material would then act as the best possible natural attractant for adult flies; and its attractiveness could be further increased by a spray of sweets. With hogs and poultry getting their other food within such enclosure whenever it is not practicable to let them run at large, the flies can thus be kept concentrated and minimized.

In laboratory experiments it was found that "adults fed greedily" (upon a mixture of water and finely divided papaya) "and soon became distended, In this condition many fall and rest upon the bottom of the jars" (D. A. Bull. 491, p 18). Hence there should be no difficulty for poultry to secure the flies feeding upon such material.

The Mediterranean fruit fly is of much greater importance than the melon fly, because it will attack every known fruit with the exception of pineapple, banana and olive. [Ent. Cir, No. 160 p 10]. "It is without question the most destructive fruit pest in the world today" [p 10]. Thus unless control measures are such that they can be used on wild vegetation, they cannot be expected to be of much avail. I shall show that the use of stock of as wide a range as possible, and with poultry as an essential factor, when necessary in connection with unpoisoned baits, will solve the problem—both on wild and cultivated vegetation.

"...When fully developed, which usually requires a fortnight or three weeks, the larvae leave the fruit, which as a rule has fallen several days previously, and enter the ground. seldom going deeper than one inch, depending on the nature of the soil. Here they soon change to puparia and remain for twelve days to three weeks, depending on the season. When the transformation to adult is complete the fly pushes through the end of the puparium and works its way up through the soil. On reaching

the surface the wings expand to full size and in a short time the fly is ready to search for food. They are fond of the exuding juice of injured fruit" (p 14). In Hawaii there are about eight generations a year. That means that a system of control, to be successful, must be such that it can be used right along without incurring excessive cost. Stock, used if necessary in connection with unpoisoned sweets, is the only thing that can be thus used.

Since the adults are fond of the exuding juice of injured fruits, this gives us a chance for a special means of control. Evidently sweet, overripe, aromatic fruit is strongly preferred. Hence for best results poultry should be confined where these drop. Thus, it is explained (D.A. Bull p 16) that the fly cannot mature in papayas until they become overripe, but that "as many as 205 flies have been reared from single overripe fruits."

It will thus be seen that such overripe fruit, if exposed for feeding and oviposition purposes on the ground, could be made to serve as concentration points for the adults where not only the adults can be secured, but also poultry would pick for larvae in the fruits and for pupae below the fruits in the ground, this, too, in Hawaii, every day in the year. Naturally, if overripe fruit is available, there is no need for using any sweets.

"Peaches cannot be grown at present, for they are ruined before they become well grown..." (D. A. Bull. 140, p 14). If more suitable oviposition material such as overripe fruit, or fruit crushed, sweetened and scented be provided in the peach orchard, the peaches could be protected. Mr. O'Kane gives the average length of time for oviposition by the apple maggot as about three minutes. If in the case of the melon fly and the Mediterranean fruit fly the period of rest for feeding or oviposition were only three seconds, this would be ample for poultry to secure vast numbers of adults,

"The food of the adult melon fly consists of plant juices, honeydew, nectar, or even the juices of dead insects" (491, p 21). "The observations of the writers" (Back and Pemberton) "would indicate that adults obtain the larger portion of their food from honeydew, and especially from the juices exuding from

the injured portions of their hosts. Adults are found in large numbers on foliage covered with the exudations of honeydew, no matter whether it is formed by the cane leaf hopper... on sugar cane, by the green scale... on coffee leaves and fruit, by the corn leaf hopper... on tassels and leaves, by the bean aphid... or by the banana aphid... Wherever honeydew is present, the melon fly is among the many insects attracted" (p 22).

"The adults are particularly fond of the juices exuding from the ruptures made by the female in the epidermis of the host while forming the cavity in which to deposit eggs. Cucurbits in general exude considerable juice when injured and this is eagerly eaten by both sexes of adults. Fruits broken in the field, crushed vines, and even the decayed areas in infested fruit are attractive to adults..." (p 22). "...melon flies mate only at dusk and only after they have become somewhat older than adults of *Ceratitis Capitata* [Med. fruit fly] [p 23].

Recent feeding experiments with the melon fly have shown that certain foods may play an exceedingly important part in the stimulation of bodily forces, sexual activity and egg maturation. These experiments have shown that the use of fresh cucumbers, cut open and kept constantly in the jars containing the adults, would so accelerate the development of the reproductive system, that copulation commenced as early as ten days after emergence from the pupal stage. Thus, in four lots of flies., comprising a total of 1230 adults, mating commenced with a few individuals in each lot, successively, at sunset, the tenth day after emergence.. This is a most striking condition when comparison is made with the ages at time of first mating of adults that are confined in jars of similar size, but fed on papaya and water or sugar and water. Many hundreds of adults kept confined... and fed on papaya and water were never seen to mate before 20 days after emergence.." [p 23].

Flies on honeydew on sugar cane, corn, coffee, bananas or fall beans cannot be secured by poultry. The use of a hot air blast torch is far the best means to keep down the insects that produce the honeydew.

"The melon flies are rapid fliers and are often found far from their host plants..." (D. A. Bull. No. 491, p 55). This shows

that proper bait would exert attractions over a wide radius.

In making poison tests the investigators used the spray at large, using 30 gallons per acre. It must be clear from the foregoing evidence, that merely poisoning specially attractive fruits would effect a great saving in cost. There can be entertained no reasonable doubt that the flies can be cheaply poisoned by means of specially attractive traps. Neither can there be any reasonable doubt that such poisoning would also destroy the other insects feeding upon such bait. This would then mean the annihilation of all beneficial, neutral and injurious insects attracted.

As usual when they have no practical means of control the Entomologists shout themselves hoarse about the value of the parasites they have introduced: "The very climatic and host conditions that have made the Mediterranean fruit fly an unusually serious pest in Hawaii and that, with crop conditions as they are, have made artificial methods of control impracticable, have been most favorable for an attempt at control by means of parasites. An abundance of the fruit fly upon which to feed and a climate permitting increase each month in the year have made conditions ideal. The search for and discovery of parasites, and their introduction and establishment where previously there had been none, has been one of the entomological romances of the present time..." Of the "...four promising parasites... only one, the South African *Opius*, was discovered as a parasite of the Mediterranean fruit fly. The three others were found parasiting other fruit flies and they have adapted themselves in Hawaii to the Mediterranean fruit fly..." [D. A. Bull. 640, p 29], which is just what we have known all along to take place in similar cases, with natural enemies of the boll weevil for instance. "...The rapidity of establishment and the increase of the parasites have been very gratifying," [p 40] [now prepare for a drop from the dizzy heights] "yet while parasitism in thin-coated fruits, such as coffee, may be consistently very high, in thicker fruits, like the orange, it is consistently very low... adult fruit flies... have been able... thus far to keep such an ascendancy ov-

er their parasites that they cause the infestation of practically all fruits ripening." And, honest, "It would appear that unless effective pupal and egg parasites are introduced... little practical value will result from the work of the parasites from the stand-point of rendering host plants free from attack."

The egg stage is passed under the skin of the fruit and in summer normally lasts only two days. Where then has an egg parasite a chance? Similarly, not much can be expected of a pupal parasite. "The small brown ant," (a predaceous enemy) "so common about the lowlands of Hawaii, unquestionably is a factor in natural control. It is frequently found swarming over and in fallen fruits and kills many larvae as they leave the fruit to pupate..." (646, p 38) If the flies were killed with poisoned sweets this would also kill the ants by causing them to feed upon these sweets. Ground beetles can be expected to attack the larvae and pupae. They would feed upon adults killed by poison and be most likely killed in return. They cannot be expected to naturally hold such a pest under control,

In Kona, Hawaii, where the percentage of parasitism in coffee cherries has been phenomenally high for three years, it has not been high enough to free more than an occasional cherry from attack.

For artificial means of control the Bureau advocates clean culture, destruction of infested fruits, and spraying with poisoned sweets.

"Clean culture in its broadest sense includes not only the destruction of all infested fruits, but also the elimination of useless or unnecessary host vegetation. In some one or all of its phases it has been recommended and practiced in every country where the fruit fly is a pest, but in nearly all of these the apparent indifference displayed by the majority of the people, no matter how much they may have lamented their losses, has rendered clean culture inefficient" [D. A. Bull. 640, p 31].

This is the Bureau's way of putting it. But the people in question have a little gray matter of their own. They know that if they were to adopt this kind of clean culture, that by the time

they apply the principle advocated by the Bureau in the many different cases of insect- and fungus diseases they have to contend with, they would have to maintain a bare ground over their uncultivated lands, and this would ruin their country by erosion. Where, for instance, do you expect to get cheap electric power from, unless you keep the mountains and hills clothed with dense vegetation? Under the Bureau's plan the rivers, reservoirs and ditches would fill up with sediment because of floods, with no water supply worth while between times.

Destruction of infested fruits is practicable if properly conducted. To this end it is necessary to use stock wherever possible, which is practicable or can be made to be so, in the vast majority of cases. On pages 30, 32, 33, No. 640, the authors show trees on rough lands from 10 to 50 feet high, saying, "there are numerous large trees beneath which infested fruits may be gathered each week in the year, yet the trees are so tall and brittle that no inspector can remove the fruits before they ripen." (p 32). The remedy suggested is clean culture the use of an axe to get rid of the trees.

The Agricultural Yearbook for 1917, beginning on page 185, gives an account, now available as a Yearbook Separate, on the "Danger of Introducing Fruitflies in the United States." On page 188, Mr. E. A. Back, the author, points out that there are at least 20 kinds of fruitflies outside of Mainland United States and that any of these might seriously affect our food supply, if introduced. On page 192 he says that many of these "appear just now to be of little economic importance, this, however, may be merely because they are living at present in countries not yet developed agriculturally and are forced to subsist upon the scattered small native fruits, or are held in check by natural enemies. Thus the Mediterranean fruit fly is so rare today in western Africa—its native home—...that no one would think of listing it as a dangerous pest. Yet once it had spread to old settled countries, it proved to be a ruinous pest of practically all cultivated fruits. In South Africa the Natal fruitfly was origi-

nally an insignificant insect attacking the fruits of native trees in Natal. But with the development of South Africa... it has itself kept pace with fruit production... It is hazardous, therefore, to ignore even those fruitflies that are at present of little apparent importance as pests, inasmuch as any of them, once introduced to a more favorable country, may develop into a pest of prime importance..."

These fruitflies, with the exception of the olive fly and possibly some others which pupate within the fruit, normally pupate in the soil, usually below the fallen fruit they emerged from. Thus, "a fruitfly chrysalis, or pupa, was discovered in New Zealand in soil about the roots of a plant imported from Australia." "But these flies frequently also pupate in other places, for instance in packing material of all kinds, or they may leave an infested fruit in a trunk and pupate there, or within clothing or bedding. Thus it becomes practically impossible to guard against their introduction on a small scale. This is shown in a practical manner by the fact, that the Department of Agriculture had been watching against the pink boll-worm, an insect much easier to keep out than are fruitflies, yet the pest has got a good foot hold in Texas" (See Yearbook 1917, pp 56-60).

"The other infestations" (of the pink bollworm) "...near Trinity Bay, ...are much more serious on account of their intensity and the wide area involved... The latest information indicates that it has spread .. for a distance of approximately 100 miles... it is suspected that the infestation is of several years' standing" (p 57). Yet in a Circular issued August 7, 1914, the Bureau of Entomology declares that for several reasons it seems certain that the insect has not already become established in the United States, thus proving that the insect got a hold on a large scale in spite of reasonable watchfulness on their part.

It is now proposed to stamp the pest out, chiefly by prohibiting cotton growing along the Mexican border and around the infested areas, involving the keeping down of volunteer cotton. As near as can be seen the pink bollworm, like the boll weevil

and the common bollworm, is not a dangerous pest, unless allowed to unduly increase. I had shown in my Circular No. 152, pp. 33 to 35 that this pest could be easily handled, same as the boll weevil and bollworm described there—in essence by the use of poultry in connection with a centrally located trap patch of late planted cotton.

In cases where the flies liable to be introduced pupate in the ground, the control is substantially the same as already described for the Mediterranean fruitfly and the melon fly, differing merely in using as attractants the fruits they normally live on. In the case of such fruitflies as pupate in the fruit, as does the olive fly, a more aggressive method of control is necessary. It is obvious that first of all the food plants other than the olive must be either destroyed or the infested fruits must be taken care of. These fruits must be either gathered and utilized or eaten by stock, hog probably being best. Infested olives have a market value, chiefly for making soap. What is needed in addition is some means of keeping down the adults. Poisoned olive juice displayed one way or the other would probably be effective; in that case it will also be effective in killing off most of the useful insects, hence can, as a rule, not be recommended,

It seems no other means than poison spray has as yet been suggested. How then, does the Bureau of Entomology think this will work? Take a board 12 inches wide, one inch thick. Cut into pieces one foot long. Take one of these squares and nail cleats 1x1 inch around the edges. This makes a shallow trough 10x10 inches square and one inch deep, inside measure. Place a number of these troughs through the orchard. Pour into these troughs a liquid made out of water and mashed infested olives, selecting as far as possible the ripest ones. Tests are likely to show that the addition of saccharine matter is helpful. This liquid naturally will attract the olive fly and many other insects as well. To get rid of the flies keep poultry. It would not be necessary that each orchardist keep poultry, but a man in a given neighborhood might keep a suitable flock and by

being given the run of infested orchards could keep down the flies. Use these troughs at the same time to feed the poultry some bran mash, or anything else that is available, feeding but little at a given time, but feeding often, the object being to keep the poultry attracted to these troughs much of the time. Bran mash would do this better than most solid foods, since it takes much time for poultry to pick it up and since much of it finds its way into the angles and corners. It would naturally be helpful in attracting flies, if mashed infested olives are mixed into the bran mash. With the troughs thus kept soaked with water containing olives, this will cause the flies to frequent the troughs and as most fruitflies do not begin laying eggs until they have fed a considerable length of time after emergence, an intensive use of these troughs, frequently watched by poultry while flies are at all plentiful, together with the prompt disposal of infested fruits, should readily keep the pest under control, and at a small part of the cost of using poison as now employed, or at least advocated.

This principle is applicable equally well to other fruitflies and also to other insects. Take for instance the codlingmoth, In a Bulletin issued by the late M. V. Slingerland, Entomologist at Cornell University, Ithaca, N. Y., he states in effect that in the twilight of a warm late-summer evening he saw a great number of codling moths feeding on and flying about a number of fallen sweet summer apples. Now if these and other attractive sweet summer apples had been made inaccessible to these moths and if some of these apples had been mashed and with water added poured into troughs as described, there can be no reasonable doubt that this mixture would have attracted the moths. Neither can there be any reasonable doubt that if this mixture had been poisoned, the moths, and other insects attracted, could have been killed. It would seem the use of poultry, in connection with unpoisoned bait, would be at least partly feasible,

Generally speaking, in killing injurious insects, there are also killed beneficial and neutral ones. If poisoned bait is used,

especially in the form of a spray as advocated by the Bureau, it is usually difficult to tell what beneficial insects are also being destroyed. The use of a light trap that traps in the case of insects that are attracted to light and cannot as readily be handled otherwise would do away with this difficulty. In my Circulars No. 139 to 152 I repeatedly described how the torch shown on last page, or some similar make, may be fitted up to do this work. I now propose to show how this torch may be made especially attractive to the codling moth and other insects by making bait an attractant in connection with the apparatus. Originally I used the torch as follows: The torch was hooked on the limb of a tree or on a tripod about 10 or 12 feet from the ground, hose and pipe carrying burner being allowed to hang perpendicularly down. In order that there may not be any strain on the hose a stout cord is previously made to give some slack. On the burner, it will be found, it is easy to hang a pail. This contained some water and kerosene. It was found that while thus, compared with other traps, many insects can be caught, there was a great absence of heavy insects, most of which are highly injurious. As is the case in all other traps, I showed thereupon that if the burner be provided with a sort of tin lamp shade, obtainable of any tinner, so as to allow a ring of light about $1\frac{1}{2}$ inches wide to shine forth between bottom of shade and top of pail, insects once admitted cannot nearly so well get away again. To reduce their chance of getting away to next to nothing, there was to be fitted in addition into the pail at its top another cone-shaped attachment of the shape of a funnel, a hole in the center being provided there to allow the insects to fall into the pail below. This with the blast blowing down into it makes it virtually impossible for an insect to get out. An insect thus admitted from the darkness without through the ring of light into the chamber formed by the two corresponding cone-shaped fittings, comes suddenly into what by the sudden change and confinement is a strong light, although in reality it is a dull reddish-yellow light and does not permit the insect to gauge the distance correctly as it approaches, thus causing it to fly into the lighted

chamber and come to a stop unexpectedly by bumping against the red hot burner. The insect then naturally will recoil from the burner against the hot sides. This with the heat and the blast into which they are thus thrown nearly always immediately stuns it and thus disables it momentarily, causing it to drop and fall through the hole in the lower cone into the pail below, there through the heat and poisonous air to become quickly unfit to make a fight for life and thus to quickly succumb. I had shown in my Circular No. 147, p. 5, that under the circumstances there is no need for any kerosene and water, large accumulations of heavy insects being simply automatically burned up, an advantage possible only with this type of trap. Now if there were some sweet apples cut up in pieces, and some water put in, the heat would soon cause them to give off a smell highly inviting to the codling moth and other insects. This would make it possible to trap many codling moths even with fallen attractive apples on the ground.

There are many insects attracted to light that are as difficult to control as is the codling moth, or even more so. As for traps, a trap, other things being the same, made especially inviting by the use of bait, will give superior results. The Entomologist for five years past was urged to satisfy himself that the codling moth is attracted by light such as is furnished by a torch, since, if they are, it means that many other important insects in the absence of satisfactory other methods can be controlled more or less perfectly in this way. The pink boll worm, for instance, is reasonably certain to be easily caught in a trap as described, and this means could be used were there no other, easier means of control.

Since according to the U. S. Entomologist I am wrong on every point — on everything I have ever written — you may just as well look at what he and his scientific staff call a trap, given more in detail from Farmers' Bulletin No. 788, p. 9, on page 7 of my Circular No. 151: "...a method ...consists in placing shallow pans around the electric light poles, ...the moths flying against the globes drop into the pans..." Simplest thing on earth

you see. Experience has shown them that the general public gulps down such things with relish, Those that want to get the results claimed, may see how they get them. Whether these pans are to be suspended by stationary balloons or some other simple and inexpensive method so as to bring them anyway near and below the electric lights, so that there is a chance for the moths to drop in, is for him too much trouble to explain; the naked truth is the whole thing is a fake, being absolutely unworkable.

It must be manifest that any strong vigorous insect accidentally sitting down upon the kerosene film usually gets away again substantially uninjured, but even if such sitting down were fatal, the numbers that could thus be secured would be infinitesimal compared with the supply to draw from. A torch loses its value near the much brighter electric lights. Where these or other bright lights are available I would employ quite a different means of securing results. For instance, the brown-tail moth of New England is strongly attracted to light and infestations are more or less concentrated to cities, town and villages. At slight cost the pest could be controlled. As the case stands, the U. S. Entomologist has full opportunity to show you how to get rid of the pest by the electric light route.



**The Reinlein
Knapsack
Gasoline Torch.**

*Patent No. 739,221.
Sept. 15, 1903*

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On The Use of Poison in the Control of the Boll Weevil

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Circular No. 154.

Feb. 20, 1919

The recent publication of Agriculture Bulletin No. 731 entitled: "Recent Experimental work on Poisoning Cotton Boll-weevils" gives an interesting record of increased yields of cotton secured through applying poison late in the season. No explanation is there offered why this same poison, applied earlier in the season, invariably fails to give satisfactory results. It is known that the success of late-season applications of poison rests upon the habit of the weevil to drink water collecting upon the poisoned leaves as the result of the formation of dew. But such poisoned water had been available early as well as late in the season, and only late in the season have there been found to result any decidedly favorable results. What is the reason? To me it looks that as long as the cotton plant is succulent, the weevils secure enough moisture in feeding on squares and young bolls as to need little if any water collecting upon leaves. Or, partly also, early in the season, if water be needed, enough will condense as dew within the bracts where poison cannot be successfully applied.

If this explanation is correct, it will mean, it would not be possible, at least not to any great extent, to poison the weevils shortly before hibernation time, if it were attempted to concentrate them upon an abundant supply of squares that would be found upon a small patch of cotton planted purposely about two months after the regular time, for these squares would be nearly if not quite succulent enough to do away with the weevil's need for water. Unless the weevils, which because of new growth on

the old plants in response to possible fall rains have been rapidly multiplying, can be reduced by further poisoning, great numbers would enter hibernation under this plan of control.

The yield secured as the result of the application of poison as given was secured as a late crop, the illustration in the Bulletin of fields ready for picking serving as tests being taken between October 12 and 30. The present official system of controlling the boll weevil has for its chief reliance the early destruction of the plants in the fall. Aside from what effect this late presence of food and breeding material has upon weevil abundance the following year under this method of control, the question arises to what extent the poisoning of the leaves, through poisoning natural enemies of the boll weevil decreases the presence of these natural enemies the coming year, together with what effect such poisoning of the cotton crop as a whole has upon beneficial insects in general, and also upon all other insects, for most injurious and neutral ones are in a certain degree beneficial through feeding upon the flowers of plants and thus promoting their fertilization.

Thus it becomes a serious question, no matter how grand the immediately apparent results from the use of poison might be, how much harm has been done to the cotton crop and to crops in general of the ensuing year. The writer of Bulletin No. 731, Mr. B. R. Coad, concludes with this statement on page 15: "With the present lack of information on so many important points, any attempt to poison the weevil by the inexperienced may very easily result in actual loss."

Compare this plan of using poison with the plan of control described by me in my Circular No. 152, pp. 1 to 16. In substance this plan consists in using poultry the year around in connection with a trap patch of late-planted cotton. Suppose you have a cotton field 1000 feet square. At planting time mark off a square 100x100 feet in the center of the field. This space, forning only the one hundredth part of the field is to be planted at such a late date, as to produce squares in abundance after the main patch has reached the age at which, normally, it would

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(3)

have plenty of fruit but no squares. By keeping poultry in sufficient numbers to enable them to have an appreciable effect upon insects, on this crop, other crops, and also land not under cultivation—quite feasible since they secure most of their substance by merely being given the run of the land—and feeding them some grain at frequent intervals in this trap patch, the poultry will steadily secure adults and will also steadily pick on fallen infested squares. If the main patch under this arrangement does not, because of weevil presence or because of other causes, as a consequence produce till frost, it is to be cut off with the stalk cutter. This then leaves the trap patch as attractant with the weevils present there in large numbers up to and well after frost, the adults during cool spells being hidden under fallen leaves and readily found by poultry. During winter, poultry, by frequently patrolling the field and the surroundings, keep on reducing the number of weevils and of other insects. In the spring the weevils come mostly from the side which offered the best winter quarters. By feeding poultry slightly but frequently alongside that edge or these edges of the field, they will secure most of the adults then feeding in the tips of the young plants and keep this up all over the field later on. Of course they thus secure a vast amount of other insects, many of which are not amendable to the use of poison. In this way insects such as boll weevils and sucking bugs, will as far as they are concerned, be unable to prevent the plants to begin early to set fruit and keep this up till frost.

Of what use would it be if you could ever so successfully control the boll weevil by poisoning, but if you had enough of bugs, lice, grasshoppers, and spiders, rust, boll worms, stem- and root infesting insects, injurious ants, or others that either cannot be controlled by poison or at least would require a special application? Many of the biting insects are not readily amendable to the use of poison and the sucking insects of course, are not amendable at all. Poultry will take care of a majority of these, especially in conjunction with a trap patch, while aphids red spiders and rust can be kept down cheaper by the use of a

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torch than by any other means.

As for aphid control the Bureau of Entomology in Farmers' Bulletin No. 914, p. 8, says that natural enemies keep the aphids down as a rule. Why then is made this rule on page 15 to be followed every year as a preventative measure: "All weeds in the vicinity should be kept down throughout the year..,"? Any reasonably strong stand of pasture and meadow—and good farming requires that there be strong stands—will answer the same purpose. The same is said in Agriculture Bulletin No. 416, p. 60, in regard to the red spider. Since the Bureau gives 183 kinds of food for the red spider alone, if we were to cut out the wild food plants of each insect, we would not have a green thing growing to cover the ground not under cultivation and thus prevent erosion with its attendant evils.

Take grasshoppers. In cotton according to Farmers' Bulletin No. 890, p. 10 they "...usually advance from nearby waste places. Where young grasshoppers appear in great numbers, they may be controlled by kerosene, crude oil, trapped by the poisoned bait mentioned for cut worms..." Why not then patrol these waste places with poultry? The grasshoppers after having done damage to the cotton and when ready to oviposit usually lay their eggs, in sacks, outside of the field in waste places, slightly under the surface of the soil. Poultry given the run of these lands during fall and winter will, where these egg sacks are at all plentiful, secure large numbers of them, gaining a large part of their sustenance at this time of the year from this source alone. With the hatching of the eggs the young naturally become the continued subject of attack. It is manifest that poultry must be provided in quantity comensurate with the extent of work to be done.

On page 24 of No. 890 the Bureau speaks of the "double roll of ants," saying that many are helpful to keep down the boll weevil, chiefly by attacking larvae in fallen infested squares. But with the cotton belt rapidly becoming overrun by the Argentine ant to the exclusion of other ants and this ant on the whole highly injurious although it attacks boll weevil larvae, and

this ant finding its stronghold in uncultivated areas, whence to invade cultivated areas and houses and to foster the increase of aphids and scale insects, the question of its control as a means to prevent the resulting increase in the abundance of the cotton aphid and of aphids and scale insects in other plants becomes of prime importance. The Bureau has not the slightest suggestion to offer as to means of controlling the Argentine ant at large. The nearest approach to control the Bureau can give is by pointing to wild birds as feeding upon it. That wild birds under present agricultural development cannot cope with it, is shown by the fact that the ant rapidly spreads. Why not then make up this deficiency by an adequate use of domesticated bird life under the supervision of man? Moreover there is another side to wild bird life that must be considered. "...Damages (by birds) to fruits in Arizona and to rice in Louisiana were investigated and such remedies applied as were possible under existing laws..." (Agr. Yearbook 1917, p 91).

There need not be any mystery about what previous investigations along this line have shown. They have shown, for instance, the bobolinks go north in the spring and south in the fall. As agriculture became more and more developed, the bobolinks found when traveling south in the fall that man to make up for the destruction of much of their regular food supply had planted rice patches and they quickly adapted themselves to the abundant hospitality thus offered in spite of all the maledictions heaped upon them by the rice growers. It is the same with other grain- or fruit-eating birds, when their food has been either destroyed or been amplified by choicer kinds furnished by man. It simply means that wild birds, harmless under natural conditions, like insect or any other wild animal or plant, become pestif, if provided with unnatural conditions that favor their increase.

It is evident that the more agriculture is developed, the less benefit can be derived from wild birds and the more damage is to be expected. Their place must be more and more taken by poultry working under the supervision of man. Large flocks must be kept and these are to be used in field and forest wherever they

can be employed to advantage. The Bureau, for instance, records cases of decided benefit where poultry in appreciable numbers were used to attack the alfalfa weevil. The details of these cases, as given by the Bureau, go a long way to prove that it would have been highly profitable to carry out poultry farming under alfalfa weevil conditions on a much larger scale. In my Circular No 146, 1915, I went into detail showing how poultry can be made to control the New Mexico range caterpillar.

Poultry, by selection, has gained in weight, rapidity of growth and egg production, but has lost its power of ready flight; this makes them easily controlled by man, but makes them of use only for insects on or near the ground. In the case of cankerworms on fruit trees for instance, I had shown for five years past that these worms might be licked off by a slight hot air blast, to be eaten then by poultry on the ground. What is the use to spend a lot of time and money trying to kill such worms by poison, when a slight licking will make them drop, and poultry will put them where they do the most good?

Upon the publication of my Circular No. 152, which on pages 1 to 16 describes in detail my system of controlling the boll-weevil, an effort was made to get several of the southern State Entomologists to render an opinion as to the merits of the case. There was no response by any of them, although several Commissioners of Agriculture had displayed keen interest and had referred the matter to them for action. Only in one case was there elicited a statement of any sort, and it came from a State Horticulturist, referred to on page 26 of my Circular No. 152, who had previously expressed himself as much interested in the control of the boll-weevil, and who had been asked to get his State Entomologist to point out any soft spots that might be in the system of control as described by me. He said, under date of Aug. 2, 1918, I am wasting my time to discover a boll-weevil remedy that most of the people of his State care nothing about, and that it seems to him that there will not be enough boll wee-

vils in his State this year to go round; he said a man told him the crop this year promised nineteen million bales, and that another smarty had told him he is not interested in any system of boll weevil control. This led me to calling the attention of his Governor to this matter, that he might see how faithfully the interests of the people are looked after by the State officials in charge, and in time I received word from the State Horticulturist in question saying that I wrote to the wrong man when I tried to secure his dismissal. Well, I did not want his dismissal, at least not if he and the State Entomologist were willing to point out what soft spots there are supposed to be in my system of control. This they did not do. But the State Horticulturist said their colored cook, Aunt Hettie Dawson, says chickens won't eat boll weevil, whereupon I said, whereas he and the State Entomologist refuse to officially endorse Aunt Hettie's statement, if they wanted her to be the whole cheese, it would be only fair for the State Entomologist to do the cooking and let Aunt Hettie hold down his job. I also asked him to get a statement from Aunt Hettie whether or not chickens eat Argentine ant, preferably with his and the State Entomologist's endorsement. There was no reply. He had said previously he was working under the U. S. Department of Agriculture and was not appointed by the Governor. It is just because the Department does not want to talk that I made an effort to get the State Entomologists to talk, but you see they know that if they talk, either way, they are liable to be dropped off the pay roll.

So there you are; for my part I am in no hurry. If the Commissioner of Agriculture of your State wants to know the truth he can get it to his own satisfaction by having the Members of Congress from his State ask the U. S. Entomologist to make a statement. Any old statement will do, provided he then hears my side and then draws his own conclusions. The Department cannot hand me a crooked deal without handing a crooked deal to the people.

A similar effort was made with the State Officials of New Mexico in regard to the system of controlling the New Mexico

range caterpillar, described in my Circular No. 151. The State Biologist-Entomologist did not show any disposition to take this matter up, but after some effort on my part made these statements: "...I judge that the Department of Agriculture is perfectly able to decide on the practicability of methods of investigation of injurious insects. Matters that are in their hands I leave in their hands. In regard to your proposition for the control of the range caterpillar, I may ask if you know how many square miles are infested, what is the population of the infested territory, what is the nature of the country, the number of poultry that would be required to patrol this territory effectively, the number of natural enemies of the poultry, the number of accessible acres for the production of other food for the poultry, the amount of such food required on such a project, the expense, and, finally, the possibilities of marketing..."

This State Entomologist professedly has nothing to do with this matter altogether, affecting as it does the people of his State more than any other insect, with the exception, possibly, of grasshoppers, in the control of which, at large, the use of poultry is undeniably the very best means, since it means employing natural enemies under the supervision and ownership of man. All the disputed points had been carefully discussed previously in my Circular No. 146. If the Department had been willing to take up the matter there would have been no need to try to have the State Entomologist take it up. The infested territory is a stock raising country. If a country can normally support cattle and sheep, why not poultry? In Department of Agriculture Bulletin No. 443, p. 4 you read: "...In many instances in addition to its damage to the range grasses, the range caterpillar has seriously injured cultivated grains and forage crops... As the range country of New Mexico is rapidly becoming a dry farming and irrigated agricultural district, it is evident that the range caterpillar, unless checked, is likely to become a serious pest to crops..." Thus to protect the farmers you need at least something better than to trust to control by natural enemies, which is the Department's only proposed system of controlling

the pest at large. On page 11 you read: "...Cultivated areas usually may be protected by winter burning the surrounding egg-bearing grass, weeds or other vegetation. However such burning destroys the grass crop for that year, and unless carefully conducted may result in the burning of buildings or timber in the vicinity." This is a highly expensive way, because such burning destroys the fertility of the soil and invites erosion. Such a plan carried out generally destroys the fertility of the hill lands and covers the lowlands with a sediment of silt as the result of erosion. While the population is thin, suppose the range caterpillar were to eat the range clean, there would then be more people than there is support for; on the other hand, if improved methods produce prosperity, there is no trouble getting the necessary people located. For instance, by expensive systems of pumping large tracts of cheaply bought land in New Mexico have been made to grow very profitable crops of alfalfa, and a much larger number of cattle than is normally possible is thus being raised.

The matter was explained to Governor Lindsey of New Mexico who referred it to Dr. A. D. Crile, President of New Mexico Agricultural and Mechanical College, at State College, for action. There was no action. Mr. Crile knows that he and the rest get their salt whether they earn it or not, anyway get it as long as the getting is good.

Some better results were obtained in response to an attempt to get the Louisiana State Entomologist to express an opinion in regard to the method of controlling the sugar cane borer moth, described by me in my Circular No. 151, pages 31 to 35, issued July 20, 1917. The method there described is given briefly on page 24 of my Circular No. 152 and, as there given, "rests upon the fact that the borer prefers succulent corn to cane for breeding, and the method also takes advantage of the fact that the moths hang on the plants during the day, thus enabling poultry to secure at least part of them. Trap patches of young corn are provided during the whole season, especially in late summer and fall, to attract and hold the last brood, which upon

going to hibernate in the ground," that is, in the root stock, "is then destroyed by plowing."

Soon after writing above I had concluded that the use of corn, as described, is alone amply sufficient to absolutely control the borer. To most effectively use corn, the main crop, for ears, is planted at the usual date. As this corn matures in July-August, small patches of succulent corn, planted at later dates, at intervals of about 30 days, are coming on. This corn serves as attractant and breeding ground for the moths. It is to be cut before it becomes too tough to serve as breeding material for the borer in the presence of cane. This corn can be cured for fodder, or fed green, or used for silage. The last patch to hold the hibernating brood, where practicable, can be allowed to stand to be eaten down by stock on the approach of frost.

With such a plan of control, permitting as it does of checking most effectively the 3rd and 4th generation, which are the ones that do the damage, it will readily be seen that the use of poultry to secure moths is not at all necessary: moreover the moths would in about half of the cases be out of reach of poultry anyway. At the same time, however, stress was laid upon the presence of the Argentine ant in the canefields. As far back as my Circular No. 147, pp 26 to 28, I had shown that there is available as a means of control nothing more feasible to keep down the Argentine ant than the use of poultry on a large scale in and about the canefields the year around. As is well understood this ant greatly facilitates the increase of the sugar cane mealy bug, it being estimated officially that its presence means on the average fivefold the normal damage by this bug. The U. S. Bureau of Entomology fully realizes the harm done by the Argentine ant in the cane fields. The U. S. Entomologist in his report of 1917 on page 8 says: "Methods of controlling the Argentine ant in sugarfields were tested, but on the whole the results were unsatisfactory and considerably further work is necessary." Just have your Representative in Congress ask the Entomologist whether he has tested out the use of poultry as a means of control, not only in the cane fields, but on the surround-

ing vegetation, wild and cultivated, as well. It is safe to say even now that they cannot find anything as good as the use of poultry.

With these facts in mind you will be prepared to judge correctly a statement made on Aug. 30, 1918 by Mr. W. E. Anderson, Acting State Entomologist, Baton Rouge, La: "The circular," (Nos. 151 and 152) "which you sent to the Commissioner of Agriculture with the request that he submit it to the State Entomologist to look over, has been gone over carefully. I am glad to say that the principle, which you advocate in using corn as a trap crop for the sugar cane borer, is being practiced in this State, and with good results. As to the poultry having free run in order to catch the moths when they first emerge, I do not think this is practical. I am sure that you could not get the cane growers to go into the poultry business, which would necessarily have to do in order to have enough chickens to cover the entire acreage of the plantation."

Mr. Anderson's statement that corn is used as a trap crop for the borer moth was something new to me. Because of this I wrote him, asking whether his Experiment Station or the Federal Government had published anything on this point, also asked him to express his opinion whether, with the Argentine ant generally present in Louisiana and infesting all crops, wild and cultivated, that sustain aphids and coccids, the extensive systematic use of poultry against this ant as described in my Circulars No. 147 to 152 is not a necessity. There was no reply.

As a matter of fact the U. S. Entomologist in his reports for 1916 and 1917 when speaking of the control of the sugar cane borer moth speaks of nothing but of experiments with poisons and introduced parasites. The fact that the Bureau of Entomology spends a lot of time on such an unpromising proposition as the use of poison for the borer moth shows how hard they are up for a satisfactory means of control. The borer moths emerge from hibernation during a period of about three months, 70 per cent of the egg clusters are deposited on the under side of the leaves, the young then make their way to the whorl of the plant conceal-

ing themselves in its funnel. As the whorl is rapidly developing and gathers water by way of dew and rain, it is readily seen that poison cannot be of practical value, since any one application cannot, at best, get more than a small part of the borers present.

But assuming the use of poison were successful, it can affect at most only borer and other biting insects. While cane has thus far been but little troubled with aphids, the presence of the Argentine ant indicates a rapid increase of damage from this source, another reason for the use of poultry on cane and vegetation generally.

Then in the way of new pests the weevil borers must be considered as possessing great possibilities for damage if left unchecked. The first specimen was found in 1910 in Louisiana. This was followed by discoveries at other points in that state and also at Brownsville, Texas in 1912. It is similar with the sugar cane beetle. Grasshoppers do heavy damage to cane or other crops as do other insects that might be controlled by the use of poultry and this at far less cost than any other means. If the U. S. Entomologist wants to call this theoretical, as usual, just have him come down to hard tacks and show what is theoretical.

Another matter has to be considered in this connection. It is the presence of the pink bollworm in Mexico and certain parts of Texas. Agriculture Bulletin No. 723, recently issued, gives some new information on the life history of the insect and explains how it is proposed to stamp the pest out in Texas and in Mexico as well. There is one big-little thing the U. S. Entomologist and his staff of scientists overlook, and that is that if the pink bollworm moth shows the same increase in capacity for flight the boll weevil is known to possess, when deprived of oviposition material, partly or entirely, we can expect these moths to be able to fly for hundreds of miles, if their oviposition material, squares and cotton bolls, be cut off in any given locality.

Experience in the case of the boll weevil has shown that it

flies no more than necessary to supply its needs, and that their movement may be on the average as little as 535 foot per day when feeding upon cotton plants having no squares, or may be an unknown number of miles when suitable oviposition material has become very scarce. During the invasion of Louisiana, for instance, vast numbers of weevils covered a 40 mile stretch of non-cotton producing territory without apparent difficulty. Even when squares are present, but the supply is plentiful, weevils move no more than is necessary to secure the desired food or oviposition material. Thus I had shown as far back as 1905 in my Circular No. 32, that, in a case recorded on page 87 of Entomology Bulletin No 45, and reprinted on page 115 of No. 51, a field of 35 acres upon newly broken land and situated in a comparatively isolated location was watched for progress of infestation that was considered likely to occur. There was a cotton storage house opposite the corner where infestation was subsequently found to have begun. When found on August 6 the infestation was still confined to a small area, the plat in the corner showing an infestation of 20%, the infestation growing less and less to nothing towards the center of the field. Hence, with the weevil coming from the storage house and not from the nearest infested cotton field, had not begun in July as Dr. Hunter thought, but had begun during the usual emergence period of February to June in South Texas and the weevils had from 2 to 4 months in which to spread. That the spread is usually much faster than in the case mentioned can be explained only upon the assumption that usually the infestation due to hibernated weevils is much heavier.

In the case of the pink bollworm moth we are told that although apparently capable of prolonged flight, they prefer to go no farther than the first cotton field (D. A. Bull. 723, p. 13.) But why should they want to go farther? The nearest cotton field may be 100 feet or 100 miles away. "The eggs are laid singly or in small groups on the green bolls or in the flowers" (p 12). Evidently the moth, like the boll weevil, wants to oviposit only eggs in such numbers on a given square or boll as each of the

resulting larvae will have a chance to mature. If so this means, as in the case of the boll weevil, an increase in distance of flight corresponding with the scarcity of oviposition material.

The main infestation in Mexico is in the Laguna district. The boll weevil for many years, supposedly because of elevation, had been unable to get established there, but is established there now, showing thus its capacity for adaptation from a new angle. The Laguna district has an extent of about 1200 square miles and is located about 200 miles south of the Texas border, the intervening space being covered with mountain ranges, and the whole of this district is infested by the pink bollworm, "Gough, in Egypt, found the larvae would remain in a quiescent condition for over two years" (p. 12). Thus suppose no cotton is grown in the Laguna district for 3 years. A moth usually lives about 17 days. A moth finding no cotton upon emergence goes in hunt for it. It has no other object in life than to oviposit in cotton, or, if unable to find cotton, to oviposit in some other plant likely to make it possible to mature a new generation. The Bureau has published nothing as to what food these moths take. The inference is they feed normally upon the pollen of cotton flowers, and in its absence upon nectar obtainable about cotton plants. In the absence of all cotton, there can be but little doubt that they can readily subsist for the normal period of 17 days upon pollen and nectar secured from malvaceous plants, and, if necessary, upon pollen of flowers of many other plants. Many malvaceous plants are growing wild. Cotton in Mexico grows wild, that is, the valleys in the mountain ranges to the north harbor cotton plants. These if as yet uninfested, would thus become infested. Under such conditions the moths necessarily will develop their inherent capacity for long distance flight. Hence with an average length of life of 17 days for moths that are ovipositing, which indicates a longer period of life for moths that are not ovipositing, we cannot but conclude that a moth unable to find ovipositing material will bring to naught all protection by cotton-free zones, even with a width of 50 miles at the Texas border and another 50 miles added at the

Mexico border, and thus all the enormous expense and loss it is proposed to incur in an effort to stamp out the pest will be for nothing. "...In the case of Hearne the quarantined" (cotton-free) "area included a territory within a radius of 3 miles from the mill..." (p 24). What can you expect from a cottonfree strip of 3, or 30, miles in the case of a moth that habitually swarms for 2 or 3 hours in the evening?

It is generally held by biologists that the boll weevil originally bred in the bolls of wild cotton, that thus there was originally only one or two generations a year. With access to improved cultivated varieties injuriousness has corresponding increased and the weevil has accelerated reproduction by breeding in squares and as a result there are now 3 to 6 generations. There is every reason to believe that the pink bollworm moth was thus similarly originally a comparatively harmless pest in its native home and that its injuriousness increased by access to improved varieties, grown under improved conditions. Under original conditions the food supply is never suddenly cut off, at least not over any great territory, and the pink bollworm, as did the boll weevil, thus naturally accustomed itself to feed and breed upon cotton exclusively. The boll weevil is, apparently because of attempts to starve it out, adapting itself both to feed and breed in plants related to cotton and to go without food obtained from cotton for a great length of time after late summer. With all cotton destroyed the weevils can yet feed upon pollen and nectar secured from related plants. And if these were absent, pollen from most other plants would probably fairly well answer. The fact is, that if food of any kind were untobainable the boll weevil could secrete itself in cool places, as in cracks of live bark, and thus enter a quiescent state.

In the case of the pink bollworm no definite proof seems as yet to exist that plants other than cotton can support it, but: "...a statement has been published to the effect that the insect has been reared from a closely related plant belonging to the genus *Hibiscadelphus*" (p 14). This, if true, would make the attempts at extermination all the more hopeless. If not, as the

food supply under artificial conditions is apt to be suddenly cut off, we can expect, as is known to be the case with the boll weevil, an adaptation to related food plants by the pink bollworm. To try to make the public believe that the pink bollworm can be exterminated in Mexico, and at anything like a reasonable cost, is on a par with the Bureau's claim of having a chance of exterminating the European pine-shoot moth, the European pine-sawfly, the white-pine blister-rust pest of New England and other rank humbug. Not a syllable has yet been published of what the Bureau expects to do should the pink bollworm, as is admitted to be possible, defy the efforts of the Bureau and of the State of Texas to stamp it out.

Given the correct principles of control the pink bollworm is an insect easy to control. "The pink bollworm affects the production of cotton in several ways. First a considerable number of squares and bolls are so injured that they fall to the ground. In case of heavy infestation 50% of the crop may be destroyed in this way..." (U. S. D. A., The pink bollworm, Aug. 7, 1914) or ...in the first place it destroys a certain number of bolls or portions of bolls in which case the lint produced is short and kinky..." (Bull 723, p. 5). That shows the need of attacking the pest at the earliest possible moment. "The moth is seldom seen in nature. Its habit is to hide during the day under stones and brush. The normal time of flight is from 6:30 to 8:00 p. m., The moth is so quiet in its habits and so easily overlooked that many may occur unnoticed in the field. In fact Mr. Busck states that frequently he walked through cotton fields in the Hawaiian Islands where many thousand must have been present without seeing a single one" [Bull. 723, p. 13]. It takes some imagination to combine stones and brush and cotton field. However a certain percentage of the moths may hide during the day under stones and brush near the outside of the field. The rest hide manifestly on the cotton plants. Using poultry exactly as recommended for the securing of hibernated boll weevils will decrease the number of moths. As squares and small bolls begin to fall, poultry forced to patrol the cotton field by being fed and

watered and held there, long and often enough to keep the pests under control, will attack these squares and bolls same as they are wanted to attack squares and bolls infested by the boll weevil. Inasmuch as older bolls do not fall, it is obvious that the most efficient work with poultry that can be put in is early in the season, the more so as then the moths, boll weevils, bugs and other insects acting as stemmothers are more easily found than later.

Another account: "The insect was very destructive to the American cotton" [in India]. "The egg is deposited in the germs at the time of flowering, and the larva feeds upon the cotton seed until the pod is about to burst, a little previous to which time it has opened a round hole in the side of the pod for air and at which to make an exit at its own convenience, dropping on the ground which it penetrates about an inch, and winds a thin web in which it remains during the aurelia state... The native cotton is sometimes affected by it" [Bull. 723. p. 2]. This shows the habit of the insect in bolls that do not fall at a time when yet another generation can be developed. These larvae and cocoons can to a certain extent be secured by poultry. The fact that the insect greatly prefers American cotton shows that the native is "resistant" simply through failing to offer the abundance of squares produced by American cotton. This then means that a trap patch of late-planted cotton as recommended for the control of the boll weevil and the bollworm [corn ear worm] will be the thing to keep the pest down to harmless numbers in the latter half of the summer and fall, thus insuring the crop.

Of course during the winter all seed not needed for the planting is to be utilized in such a way as to destroy any pink bollworms in them. These steps then will be amply sufficient to make it needless to go to the trouble to effectively fumigate the seed that is to be used for planting.

"...in Hawaii... the moths were clearly repelled by light. In Egypt experiments have shown some degree of attraction to light by the pink bollworm moths. but not enough to form the

basis for control measures" [Bull. 723, p. 13]. The light furnished by a torch used as a trap as described on pages 25 and 26 of my Circular No. 153 is little more bright than a ruddy glow and this light is confined within a small chamber, with darkness without. There is best of reason to believe that such a trap would readily trap those moths, if additional means of control were necessary.

If the facts here outlined are not taken into consideration, there will be waste of public funds, not by the proverbial barrel, but by the car load. Because of this it now looks as if it will not be nearly so big an undertaking to make Senator Gore, Chairman of the Senate Committee on Agriculture, and the U. S. Entomologist do their duty—or give the pair of them the bounce—than Senator Gore thought three years ago would be the case, a matter discussed in my Circular No. 148.



**The Reinlein
Knapsack
Gasoline Torch.**

*Patent No. 739,221.
Sept. 15, 1903*

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No. 155

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On The Control of Sugar-Cane Insects.

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Circular No. 155.

May 16, 1919

The world's increasing demand for sugar is resulting in increased areas being devoted to sugarcane. At the same time this increased area tends to increased injuriousness by insects and plant diseases. Very little in the way of securing efficient means of controlling either insects or plant diseases on sugarcane has as yet been accomplished. I propose to point out better means of control. As the sugarcane insects of Hawaii are pretty exhaustively treated in U. S. Dept Agri. Bulletin No. 93, I will begin with a discussion of these.

The most important sugarcane insect in Hawaii is the sugarcane leafhopper. It has been introduced from Australia. It has also been recorded from Java. With the lively commerce through the Panama Canal this exposes the canefields of the Southern States to continual danger of infestation. In addition as far back as 1841 a related species feeding on sugarcane was recorded from the West Indies (p. 34). This "insect lives in company with its larva in large numbers behind leafsheaths, which it punctures to imbibe the sap of the plant. When mature it is exceedingly active in its habits, springing with suddenness from its resting place at the least disturbance..." [p. 12]. "...The leafhopper, during heavy infestation will continue to puncture the midribs of the leaves as rapidly as the leaves unfold... Ordinarily when disturbed the adult leafhopper does not fly, but moves off in an odd sidewise fashion to another part of the leaf, or springs suddenly to another portion of the plant..." (p. 16).

As to means of control officially advocated we have to consider direct measures, indirect measures and natural control.

The direct measures are: Insecticides, collection by nets, cutting and burning the infested centers, stripping the leaves, and burning of trash after harvesting (p. 22). In practice, admittedly, none of these things are of any value. Of insecticides no tangible results could be secured. Collecting by nets "was also discarded." Cutting and burning showed "that the adults were able to take flight from the burning cane and escape to adjoining fields." Stripping the leaves "...showed... that in heavy infestation the internodes of the stalk of stripped cane contained hundreds of punctures from egg laying..." Burning of trash "...is the most effective method practiced for the control of the insects of sugar cane." But on page 33 Dr. Perkins is quoted as saying that "on the Colonial Sugar Refining Company's estate in Australia no such burning off is allowed. If this" (supposition that this increases the number of natural enemies) "is correct, it may help to account for the insignificant numbers of our cane leafhoppers here..."

One of the indirect measures consists in selection of varieties of cane for planting. As to resistance "...the Yellow Caledonia made the best showing." But as to sugar production—ton for ton—it seems to be inferior to other varieties, for, as usual, everything the Bureau hands out must be taken with a grain of salt—"it is for the planter to decide whether or not the advantage of one variety over another are offset by the ravages of the leafhopper..." (p. 24).

Another indirect measure "natural methods," consisting in intensive cultivation, fertilization and irrigation, resulted in a lower rate of loss than fields not so treated. Naturally, keeping the field clear of weeds early in the season tends to drive hoppers to places not so clear. Whether with all fields so treated this would result in a decrease in number, taking the fields as a whole, is not at all proved. Another indirect means, diversification of crops, is recommended. This means a decrease in acreage. Of course, if no cane were grown at all, and other possible food plants were kept down, it would be possible to starve the hopper out.

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Another indirect means claimed is "the control of the rind disease of sugar cane." But the control is merely declared to be desirable, for no means of control does exist.

The natural control consists in the fostering of natural enemies of the hopper. These are chiefly parasitic and predaceous insects, and certain fungus diseases. The burning of the trash is conceded to be inimical to the development and perpetuation of the parasitic and predaceous insects. And with burning of the trash, now officially considered to be imperative for the control of cane insects in general, it is now proposed, as far as control of the leafhopper is concerned, to propagate and distribute the natural enemies artificially.

Parasites are liable to be decimated at any time by hyper-parasites. "Several species of ants were very active about the leafhopper in the canefields, the honeydew being an attraction to them" (p. 28). That means that these ants will work towards the increase of the leafhopper by attacking as far as possible the parasitic and predaceous insects that prey upon the leafhopper. And altogether there is reason to believe that most of what natural control there is, comes through the working of the two fungus diseases that are present, "which long previously known to kill the native leafhoppers, have become transferred to the introduced pest..." (p. 32).

As this leafhopper lives behind the leafsheaths, there is just one thing that will work there and that is the hot airblast torch. This insect hides similarly to the chinchbug. I had shown as far back as 21 years that the blast from a common plumber's torch makes the chinchbugs and other insects capable of locomotion hidden behind the leafsheaths come out in a hurry and tumble to the ground where they can be killed by the blast at close range. I had shown that the best time for this is the cool part of the day, or spells of cool or wet weather. The higher the temperature the more readily will adult leafhoppers be able to jump or fly out of range. But during hot weather work against the adults with a torch can be kept up from the cool of the evening during all of the night and most of the forenoon, say 16

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hours out of 24. During the remaining 8 hours the work can be kept up, but the blast should approach the bugs in a backward stroke. In this way the bugs will not become restless enough to get away before the blast is upon them.

The Hawaiian sugarcane borer is second in importance in Hawaii and this insect also hides, during the day, within the lower leaf sheaths as do many other injurious insects of less importance. The use of a torch will cause them to come out, most, if not all, will fall to the ground, there to be killed by the blast. The present official way consists in collecting the adult weevils by hand, either hidden behind the leafsheaths or hidden under split pieces of cane distributed through the field.

Again, there is the sugarcane mealy bug "congregating for the most part behind the older leaves near the ground" (p. 44). An occasional licking will keep them down. The official means of control consists in "Selection of seed cane" and "Burning of trash" and, of course, "Natural enemies." Most if not all ants present protect and foster the mealy bug, incidentally defending it against its natural enemies. Hence you see a need of a means control applicable to the growing cane, as furnished by a torch. This not only kills the ants it hits in licking of the bugs, but the ants can be traced to their nests and a blast blowing about it will bring the colony out so it can be destroyed.

In Hawaii "an aphid... is occasionally injurious to cane" (p. 45). Remedy: The use of a hot airblast torch. Of course the use of a common plumber's torch is not advocated, some such type as is shown on last page should be used.

"In some districts... a mole cricket... is sometimes abundant enough to be injurious. Another species... is a most important pest of sugarcane in the island of Porto Rico... wherever the Hawaiian mole crickets were numerous almost all of the seed cane was destroyed..." (p. 46). No official remedy. Free use of poultry will probably keep them under control.

One of the most important sugarcane insects in Hawaii is the leafroller. An official means of control employed at times is "to send laborers through the fields to pinch the caterpillars in

their retreat between the folded cane leaves." (p. 42). As this insect is sometimes so plentiful as to entirely strip the canefields, this remedy will not do. When abundant patrolling the young cane with poultry will be the means of getting rid of many of the moths. These apparently hide about the plant during the day and fly during the night.

It is similar with various adults of army worms and cut worms and probably with a bud moth, mentioned on page 46. Most every year one or the other is more or less plentiful. Generally speaking the best thing that can be done is to use the torch as a trap-light at night. How to use the torch shown on last page as the most successful trap-light in existence is explained in detail on pages 25 and 26 of my Circular No. 153. It is done, in corn or cane, in substance by suspending the torch on a tripod made out of 3 pieces of light clear lumber 12 to 16 or more feet long. The tank is hooked up in the apex; hose and pipe are allowed to drop. A cord is used to give the hose some slack, removing the strain. On the burner is hooked a pail. This pail is fitted up similar to a spittoon by having a funnel-shaped cover with a hole in the center. And over the burner is placed a piece of tin of the shape of a lampshade. A circle of light of about $1\frac{1}{2}$ inches width is allowed to shine forth between the lower edge of the upper cone-shaped fitting and the rim of the pail. This allows the insects to fly in, there to bump against the red-hot burner, get stunned, and drop through the hole below into the pail. Or, if not so easily conquered, as happens with strongbodied insects, they will, in trying to get out bump in nearly all cases against the upper or lower cone-shaped fitting, and because of the narrow space, the intense heat and the poisonous air be quickly disabled to roll into the pail below. The poisonous air blowing downward through the hole soon puts a stop to all attempts to escape through this only possible outlet. I had shown in my Circular No. 153 that if sweet-smelling sweets, such as water and molasses were put into the pail, this would make the torch especially attractive to insects in general.

This torch does not make a bright light. This in some re-

spects is an advantage, as the insects attracted cannot gauge the distance correctly and are knocked silly and trapped before they know what has happened. "...The Hawaiian sugarcane leaf-hopper is an insect readily attracted to light at night..." (p. 14) The weevil borer, most likely, is also attracted to light. If so, this will be of very considerable value, since this insect attacks, in Hawaii, also the banana, coconut palm, sago palm, royal palm, winepalm and papaia. "Dying coconut palms were examined and in the tender heart of the palm were found great numbers of the insects (borers), in all stages" (p. 37). Of course a insect attacking tall trees, and living within in all stages, if attracted to light can be handled in no easier way than by the use of a trap that is capable of trapping in vast numbers. The leaf-roller moth, in all probability, can thus also be trapped. Poultry in cane fields would probably be able to secure a fair share of the weevils.

As explained on pages 26 and 27 of my Circular No. 154 the Bureau of Entomology has no system of trapping that is worth anything. Being created to promote entomological knowledge in its broadest sense, the Bureau has persistently to hinder all progress along the line shown by me by refusing to make check tests and give the results. Moreover the Bureau repeatedly told Members of Congress that were trying to get at the truth I am wrong on every point. The chairmen of the Congressional Committees on Agriculture, Senator Thomas P. Gore and Representative Asbury F. Lever have never seen to it that the Entomologist gives his reasons for making such a statement.

A torch used as a trap works automatically. A quantity of gasoline, enough to run about the time desired, say four hours, is put in, air is pumped in, and the gasoline will use itself clear up without any attention.

The mothborer of the Southern States can in all probability also be trapped, along with the weevil borers, now established since nine years in some places, together with the sugarcane beetle and other insects amenable to this method.

The chief reliance for the control of the mothborer, howev-

er, is to be found in the use of corn for attracting the last two broods, described in detail in my Circular No. 154, pp. 9 to 12, the original description being given pages 31 to 35 of my Circular No. 151. As the moths prefer tender corn to cane for oviposition, by providing patches of late planted corn in succession and using it for fodder, stover or silage, and finally trapping the borer to hibernating quarters, the borers there to be destroyed by plowing before emergence begins in the spring, the moth-borer is readily and cheaply controlled. Poultry, if present to keep down other injurious insects, such as ants, is also helpful by securing part of the moths.

Meanwhile the Bureau, instead of passing on the merits or de-merits of this method, is nosing around for a natural enemy that secures the same result. One thing in this connection the Bureau refuses to make clear to the public. It is that while under primitive conditions natural enemies do usually effectively control injurious insects, under modern methods of agriculture food plants such as cane, corn, wheat are grown in vast tracts, enormously favoring multiplication of injurious insects, while safe hibernating places for parasitic insects are far less plentiful than under primitive condition, in fact would be almost absent if the Bureau's recommendation of destroying hibernating places for injurious insects were followed. Besides the injurious insects often can breed at a mean average temperature too low for the parasites to breed.

In the Southern States the use of poultry becomes imperative in cane through the presence of the Argentine ant, which fosters the development of the mealy bug and also of aphids. These ants unless kept down by poultry, would have to be kept down by the use of a torch. This use of a torch I had shown as far back as four years ago in my Circular No. 147 is the best thing to enable poultry to gain a start at a given place. The summer nests of this ant are very shallow and letting a blast blow about them brings the whole outfit out to be killed with the greatest ease. This then gives poultry roosting—and breeding places free of ants and enables them to bring the pests under

control. The Bureau for the use of these ants in general recommends the use of poisoned ant syrup. You will readily see that in canefields or other vegetation supporting aphids or coccids this fails to work, if carried out, because the ants then prefer the excretions of these insects to all other food. Moreover all kinds of waste places make a natural home for these ants. To use poultry for control simply means to use a domesticated form of natural enemy. Further, ant syrup will poison the beneficial insects attracted to it.

Froghoppers or spittle insects have also been found as far back as 1911 in Louisiana and, like the borer, may at any time attract big attention. They are sucking insects and respond to the use of a torch same as the mealy bug. "...if they get established in sugarcane there is no knowing what may happen.." (Ent. Circ. No. 165, p. 4). No official means of control is suggested. Also "leafhoppers in very small numbers were observed (in 1912) several times during the season on sugarcane. but no injury due to them could be detected." (Ent. Circ. No. 171, p. 6). There also is "no knowing what may happen."

Another moth borer. *Castnia lieus*, exists in the West Indies. Its range extends northward to Mexico. "Collecting the moths by means of nets in the hands of children has given better results than any other direct means.." Ent. Circ. No. 165, p 3. The adult is a day flying moth. Poultry might be able to secure some when ovipositing. "...The pupal stage is passed in the cane or in the soil near the underground portion..." (p. 2) Hence poultry might be expected to secure some pupae. "Its original food plants were species of the orchid family and of the family of plants to which the pineapple belongs (Bromeliaceae)... in Trinidad it is known to attack sugarcane and bananas..." This would make it appear likely that, if introduced into the United States, it could be controlled by trapping it to corn same as the mothborer we now have.

The recent publication of Farmers' Bulletin No. 944: Controlling the Garden Web Worm in Alfalfa Fields, through point-

ing out the danger of serious damage by this species, and through failing to offer a satisfactory means of control makes the evidence given there suitable for showing the need for developing poultry raising to a scale large enough to enable the farmers to cope with such pests when affecting cereal and forage crops, and also for pointing out the advantage that can be gained by trapping with light-traps certain insects, that are attracted to light, hence amenable to trapping, but which insects are not, because of poisonous hairs they carry while in the larval stage, or for other reasons, such as being out of reach, amenable to attack by poultry.

"The garden web worm... has caused extensive damage to alfalfa in California, Nebraska, Iowa, Missouri, New Mexico, Kansas, Oklahoma and Texas. In infested localities of the last three states it is not uncommon for second or third annual cuttings to be entirely destroyed by the pest" (p. 3).

The food plants are given as corn and garden crops, beets, potatoes and other plants., "various crops," alfalfa and cotton, and several kinds of weeds, showing it to be capable of existing upon most any garden and forage plant and weed. The moth appears in the alfalfa fields about May 1st. After mating they deposit their eggs, usually in clusters of 40 or 50, upon the lower surface of the leaves, usually on those near the top. "Individual females may deposit as many as 300 to 400 eggs. The eggs are laid on the alfalfa plants or on adjacent weeds... In the latitude of Kansas and Oklahoma there are, apparently, four generations annually... The form or stage in which the insect overwinters in that latitude has not been definitely determined" [p 6] Thus a female emerging in the spring from a pupa, mating and producing only 100 females enables these, at the same low estimate to produce 10,000 females in the second generation, these to produce 1,000,000 females in the third generation and these cause, at 300 eggs each hatching, 300,000,000 of worms in the fourth generation, showing the enormous potential capacity for damage. "The moths are most active at night and are strongly attracted to light..." (p. 6).

For remedies the Bureau advises: Timely cuttings, brush drags, and clean cultivation. These means are absolutely inadequate as will be shown.

Both timely and untimely cuttings will naturally kill many larvae in the field, the "timely cuttings being given at an earlier date" than is customary. They are given at any time before damage gets too serious. It is simply a matter of cutting while there is yet something to cut. This, of course, is a set back to increase; but with the capacity of the insect for increase, its large range of food plants and large number of this insect present as pupa in the ground even then and with the adults capable, if need be, of flying for miles for suitable oviposition material, an alfalfa field necessarily becomes readily re-infested, in fact probably offers the most favorable breeding material available on a large scale in the latter part of the season, especially if irrigated. A brush drag does not, under the circumstances, offer enough of a set back to amount to anything.

"Clean cultivation methods are also of much value... Since pig weed and lamb's quarter are its favorite natural food plants, it is important that fields, fencerows and near-by waste ground be cleared of these and other weeds. The pest often breeds upon such weeds and immigrates later to near-by alfalfa, which would escape injury if these weeds were not present" (p. 7). As the pest is omnivorous, if its preferred food plants were to be removed, nearly every green thing would have to be kept down for miles around, since the adults are capable of flying long distances if no suitable plant be close by. This destroys the natural grazing ground and ruins the land by erosion, affecting, in turn, the capacity for navigation of rivers and harbors, the maintenance of power plants and the production of fish, for the same plan is advocated by the Bureau in the case of many other insects infesting field and forage crops, and for insects in general. However, even if the "weeds" were "thus cleared off" for miles around, the pest would then simply feed and breed that much more severely on cultivated crops other than alfalfa when such is not available immediately following a cutting.

"In loose sandy soil" (the cocoons harboring the pupae) "are often slightly more than $1\frac{1}{2}$ inches long, but in heavydry soil they usually are not more than one-half to three-fourths of an inch long... They extend downward in a nearly vertical position, the top end even with the surface of the soil. After about 10 days... the tiny adult or moth issues..." (p. 5). Thus, as at cutting time the soil is more or less stocked with pupae, if every larva be killed at cutting time, this set back with the enormous capacity for reproduction does not bring tangible results.

The pupa is thus exposed to attack by poultry as is the caterpillar and the moth. It is reasonably certain that the insect hibernates mostly as pupa. The moths evidently emerge in the spring irregularly and at the time of any 'timely cutting' are present in any stage and can readily recover, even if the proportion of pupae then in the ground compared with the number of larvae then present be small. Thus, poultry given the run of the fields and waste places, the pest would be kept down. In addition, for quick and immediate effect, the adults can be trapped, as described on pages 5 and 6 of this Circular.

The alfalfa fields might at the same time be affected by the alfalfa caterpillar. The adult is a butterfly. The caterpillar eats of the leaves and when grown spins up as a chrysalis on alfalfa- or other stems. The insect hibernates as butterfly, larva and pupa, chiefly as the latter in the cooler sections of its range, hidden away in trash in the ground, chiefly outside of the field. Poultry thus can attack the insect the year around and keep the pest easily down to harmless numbers. In a way this is conceded in U. S. A. Bulletin No. 124, p. 28: "...Domestic fowls... play an important part in the history of this insect..." However the idea of using poultry on a vastly larger scale than is now done by merely employing the usual little farm flock is lacking, for the writer says on page 29: "From these observations it is seen that chickens may be utilized in small fields to keep down the numbers of alfalfa caterpillars and that turkeys, because of their roving nature, can be used to ad-

vantage in larger fields. Mr. Charles Springer, of Cimarron, New Mexico, informs the writer that he hires a boy to herd an immense flock of turkeys on the range, so that they may feed upon the grasshoppers destroying the grama grass and other range grasses. It seems that the same method could be employed in outbreaks of the alfalfa caterpillar ..”.

This is taking too narrow a view of the matter. Cimarron, New Mex. is in the heart of the New Mexico range caterpillar territory. I had shown in 1915 in my Circular No. 146 that poultry could be used there to keep down the range caterpillar, attacking the grama grasses and other range vegetation, and also now invading cultivated crops, not by eating any of the growing caterpillars, but by attacking the insect during the seven months of cool season while it is in the egg stage in clusters on grass, and weed stems slightly above the ground, also by eating of the young caterpillars before they acquire poisonous spines, and by eating of the pupae found in clusters on grass- and weed stems, and further by eating of the moths hanging during daytime quietly in plain view on—and weed stems during fall. All efforts to have the Bureau of Entomology admit that this idea is sound were futile. Now Mr. Springer demonstrates in practice that it can be done to keep down grass hoppers. As the grasshoppers hibernate as eggs in the ground, his turkeys have been feeding all along on pupae, adults, eggs and larvae of the range caterpillar without his knowing it. What the Bureau knew in this connection was that the turkeys do not eat of the larvae after they have poisonous hairs, but such is the case only about two months out of the twelve. And if the matter were looked into closely, it would probably be found that Mr. Springer does it at a profit of several hundred per cent. However, even if the poultry raising itself did not pay, it would pay indirectly big by preventing heavy loss to the ranch grasses and thus to the stock. As a matter of fact poultry thus given the run of vast tracts of low priced lands in large flocks in the care of a herder offers the most favorable conditions for producing poultry and eggs free of disease. The flock, it was pointed out by me, can be protected

by a movable wire fence at night. This enables the herder to trap or shoot wild animals trying to prey upon the poultry at night. At the high prices of furs, this goes a long way to keep him paid.

As a matter of fact, as explained on pages 7 to 9 of my Circular No. 154, the New Mexico Biologist Entomologist utterly condemned this plan. It must be obvious that the more the country is cleared and given over to cultivation or to pasture, the less can birds maintain themselves in sufficient numbers to cope with the injurious insects stimulated to increase by an abundant supply of food, and that the natural remedy consists in using poultry under the control of man. If the Bureau's plan of 'clearing weeds' were carried through, this would remove the natural feeding ground for poultry while the fields offer little or no picking. This renders the carrying through the winter of flocks of any great size impracticable, which is necessary to deal with outbreaks.

Alfalfa might also be attacked by the clover root curculio or by the clover root borer. The adults of both species are probably attracted to light and might be trapped. But the most practical means of control all around is the use of poultry to secure the adults as they are about laying their eggs on the neck of the roots. Poultry also may be able to secure some of the larvae. Naturally the adults prefer to hibernate in nearby rank vegetation, woods probably being the most favorable. This same course I had shown for several years keeps the alfalfa weevil under control.

In the case of the bean- and pea weevils, discussed in Farmers' Bulletin No. 983, there is at present no official means known of affecting them in the field. Poultry, if admitted after the plants have become well established, can be expected to secure many of the adults. When grown in quantity what damage poultry might do to peas and beans will be far offset by the number of adult weevils they secure. It is likely these weevils are attracted to light and, if so, can be trapped in vast numbers by the use of a torch as described on page 5 of this Circular.

Treating the seeds after harvesting with fumigants or other means to destroy the grubs within is not going far enough, for many adults emerge in late summer and fall and escape before harvest or before treatment can be given. Also many adults escape from fallen seeds and scattered pods. These then re-infest the young crop next spring and call for an efficient means of control in the field. As some of the bean-infesting weevils have as many as 6-7 generations in the latitude of Washington, D. C., it is plain that with no means of control in the field available, a small number of weevils surviving the winter is capable of destroying the crop. The use of a trap and the use of poultry offer the only chance of effective reduction during the growing seasons.

In using such a trap, of course, many other insects are caught, the catch showing just what insects, of those that are attracted to light, are becoming plentiful. Grain and forage crops on low lands are often infested by insects that normally live in rank grasses growing in wet places. Some of these are the billbugs, certain wireworms, and the rough headed cornstalk beetle, while there are other pests, having similar effect, living on dry ground. No satisfactory official remedy is known. As might be expected the Bureau advocates under these conditions the destruction of the wild food plants, but these are needed, in lowland as soilbinders and as protection to creek and river banks especially if there are no timber fringes, and on higher lands they, or other rank growth, are needed to prevent erosion. Waste is contrary to the laws of nature. What the Bureau of Entomology calls wastelands is natural feeding ground for stock and under modern methods of agriculture offers the best means of carrying poultry in the cheapest manner through the winter,

Where grassland is to be plowed up for corn, often many cutworms, white grubs, billbugs and wire worms are present. The Bureau's general remedy is to plow the land in that case as early as the late summer or early in the fall before. The aim is to starve the grub out. In the first place, a trap used the previous summer would show the rate of infestation and would re-

duce it. The most convenient time for plowing is late fall and early spring. Sod then turned down gives in a large measure support to the grubs and worms within while the corn is making a stand. In fact, it often happens that damage does not become apparent till the second year. These grubs and worms naturally want to eat of the fresh growth above ground or of the roots or tubers in the ground. In the case of corn when sprouting there is but little to eat for some weeks, hence the damage often very heavy. This can be easily remedied by drilling in for every few rows of corn a row of some quickgrowing plant alongside the corn. Anything quickgrowing and succulent will do. Of grasses rye is probably best, and turnips or rankgrowing radishes ought to be splendid. The latter might be broadcasted immediately after the plowing. Or some of these seeds may be added from time to time to the seed corn in the hopper at planting time. After the corn is strong enough these protecting plants can be removed. Poultry should have access to corn as soon as it is safe to admit it.

The Entomologist's report for the fiscal year ended June 30 1918, makes reference to several newly introduced insect pests that are capable of doing very great damage unless better means of control than are now officially advocated are made to come into play.

Among deciduous-fruit insects the so-called oriental peach moth easily ranks first. This insect was originally found in the District of Columbia and adjacent counties of Maryland, and has been described in Bulletin No. 209 of the Maryland Experiment Station, issued December, 1919. It belongs to the same family of moths the codling moth belongs to. This family, the Tortricides, is very difficult to control. The codling moth, compared with the rest, is comparatively easy to control in sections where it has only a brood and a half, as it usually has in the north-eastern United States; for the reason that it has less generations than most of the rest, and because it has been found possible to destroy most of the first brood by the proper use of arsnicals.

Where the codlingmoth has two or three broods it is difficult and expensive to control it under present methods. Here is a sample of official utterances on this point: "...Spraying experiments ...in the Grand Valley of Colorado have indicated that a schedule of six applications of arsenate of lead at the rate of four pounds of the powdered product to 200 gallons of water, with the addition of four pounds of fish-oil soap, will make a very effective treatment..." (Ent. Rep. for 1918, p. 1). The warmer the climate, the more difficult becomes control.

The oriental peachmoth, in part, differs from the codling moth in that it has four generations in Maryland in seasons when the codlingmoth has only two or, at most, a partial third: also the first two generations do not develop on the fruit, but on the young growing tips, causing a shrubby stunted growth, and cannot as readily be poisoned as can the first brood of worms of the codlingmoth. "It is impossible to keep the young twigs coated with arsenical poison, though it is possible to prevent the larvae from entering the fruit (of peach) by a thorough application..." (Maryland Exp. Station Bull. No. 209, p. 8). The insect attacks the twigs of peach, plumb, apricots and cherries. As the twigs harden, the third and fourth generations more and more attack the fruits of apple, quince, peach and probably others. "...Our most successful combination of insecticides during 1917 was a mixture of self-boiled lime, sulphur, calcium arsenate and tobacco, preceded by a winter application of concentrated lime sulphur. Applications were made on April 30, May 24, June 15, and July 13, the concentrated lime sulphur having been applied previous to April 30. This application gave a reduction of 31 per cent to twig injury..". To protect the fruits after July it would be necessary to apply poison 2 or 3 times more. It will thus be seen that the control of this insect, and of the torticide in general, leaves much to be desired. "The occurrence of the (oriental peach) pest has been definitely established (in December 1917) by the U. S. Department of Agriculture in Virginia, New Jersey, New York and Connecticut" (Md. Exp. Sta. Bull. No. 209, p. 8). This is doing pretty well for a

recently established pest and, in common with other pests yet to be discussed, shows how little can really be done to prevent the introduction of injurious pests and it also vividly shows that efforts to control them made by people other than those holding federal offices should be officially encouraged and not opposed, and that an official that opposes such efforts is a traitor to his country for purely selfish reasons.

On pages 24 to 26 of my Circular No. 153 I described a method of trapping the codlingmoth and other insects attracted to light by the use of a torch in connection with sweetsmelling fruitjuices. On pages 8 to 11 of my Circular No. 139 I pointed out in detail that while tests have shown that the codlingmoth is not attracted to light to any extent if let loose in a room that is diffused with light as would be the case in a room lighted by a large Rochester lamp, probably fitted with an opaque globe, which was the kind of lamp used to make the test the claim chiefly rests on, my own accidental experience was, that a codlingmoth flew in through an open window of my room in May and repeatedly violently flew against the chimney of a common lamp that had a stiff paper lampshade and which lamp drew all its light upon a few square feet of desk surface, the rest of the room being practically dark. All efforts to have the U. S. Entomologist test this point out to his own satisfaction and thus be in a position to act as judge, were futile.

Further, I quote from Bulletin No. 142, p. 35, Cornell University Experiment Station: "The codlingmoth has a slender, pointed tongue with which it sometimes sips or sucks up sweet substances. Le Baron saw the moths feed freely upon lumps of moist sugar and slices of sweet apple which he placed in their cage. McMillan records that they willingly fed upon sweetened water and that he has seen those of the second brood feeding upon the yellow flowers of an autumnal composite (*Grindelia squarrosa*) in the dusk of the evening," in Nebraska."

Strange enough, in spite of this evidence, the author, the late M. V. Slingerland, continues: "The weight of evidence from careful experiments indicate that the moths are not easily

attracted to alluring baits of any kind." And, more strange, he follows this statement up with this record: "A Connecticut correspondent states in the *Rural New Yorker* for Feb. 9th, 1897 that 'happening to pass a sweet bough apple-tree one evening in August, where a number of apples, half eaten by chickens, were lying scattered about, I noticed a kitten busily trying to catch some small object. On investigation I discovered that the half-eaten apples were covered with codlingmoths. There were thousands of them, apparently feeding on the fruit. They were very active when disturbed. I procured a lot of old newspapers and for half an hour or more I kept several fires burning brightly, while the kitten and I stirred them up. I don't think I succeeded in burning as many as the kitten caught. They carefully avoided the fires.'"

It is evident that these sweet apples had concentrated the codlingmoths from over a considerable area of pome fruits, and if it had been possible to kill them from time to time that area could have been thus protected against the second brood of worms. Naturally the moths avoid the fire. It cannot be reasonably assumed that even an insect strongly attracted to light, as are for instance most cutworm moths, would expose itself deliberately to injury. That, however, light loving insects do get rather frequently inadvertently injured when flying about lights was proved as stated on page 10 of my Circular No. 139, in a record given in Cornell Bulletin No. 202, by Mr. Slingerland, where a mothcatcher, "while making rather a poorer showing than a traplantern" caught about 3000 more of lace winged insects than did the traplantern. I pointed there out that the only tenable explanation for this can be found in the fact that the "mothcatcher" had an open flame, affecting lace wings, when a "trapantern" would not.

In the case of using the torch for a trap, there is no bright fire to speak of anyway. What fire there is is yellowish red and is concentrated within a narrow chamber. The insects, from the lack of light outside, cannot at all readily gauge the distance and bump against the redhot burner before they know what

has happened. The conditions given in the record could have been improved for trapping by removing the sweet apples from the ground and putting into the pail hanging on the burner of torch as part of the outfit, some of these sweet apples, crushed, with some water added. This would give off a most inviting scent. For all around use, if no cheap suitable fruit is available, molasses is apt to be best. Under this plan there is no kerosene smell to act as a repellent. Mr. Slingerland's trap-light tests carried on with the use of kerosene as a killing agent, given in Cornell Bulletin No. 202, show that, in this case, the insects caught are mostly males, and what little females are caught have mostly laid their eggs. Tests made by others corroborate this.

On page 43 of Bulletin No. 142, issued in 1898, Mr. Slingerland makes this note: "The use of baits has recently received considerable attention in Germany and in *Der Practische Ratgeber* for 1895, is recorded an account of an experiment with glasses of apple jelly hung in the trees. We glean from the report that quite a number of codlingmoths were thus captured, about half of them being females. Which shows that no matter how bone-dry things may get, the farmer, might, for industrial purposes, such as trapping codlingmoths and grape insects, put in a claim for a barrel each of hard cider and wine. The smell thus given off through this liquid being kept hot by the blast blowing down upon it, with the windfalls kept eaten up by hogs, will make this the chief source of attraction for the codlingmoth, other tortricids and a host of other insects, injurious, beneficial and neutral.

On page 18 of my Circular No. 153 I stated from D. A. Bulletin No. 491, p. 23, that tests in the case of the melonfly showed that access of newly emerged females to juices of cucumbers greatly stimulated bodily forces, sexual activity and egg-maturation. Corresponding juices in the case of other injurious insects, applejuices of some sort in the case of the codlingmoth for instance, used in connection with a trap, can then be assumed to offer the most effective means for their destruction. Also since this then concentrates the insects within a certain area,

bats and nightflying birds can thus catch a hundred where otherwise they might catch one.

In the case of the codlingmoth emergence of the adults in the spring is very irregular, but in the case of the oriental peachmoth "the first two broods are very distinct, the third and fourth more or less confused" (Maryland Agr. Exp. Stat. Bull. 209, p. 3). Hence a torch, supplied with some suitable sweet-smelling attractant, and used from time to time as needed during warm dark nights up till fall, holds out a far better promise of success in controlling this new pest than anything that has yet been devised.

The torch does not make a bright light. This in some ways is a disadvantage and in other respects an advantage. In the great majority of cases it is a decided advantage, for as the range of attraction extends, say, for 1000 feet in each direction, this about covers the area of the average farm. The farmer does not want to draw injurious insect away from his neighbors upon his farm. The brighter the light and the smaller the farm the less benefit does the farmer using a trap get and the more benefit, free of charge, do get the other farmers within the range of attraction of his trap.

Inasmuch as any means of controlling injurious insects, destruction of hibernating quarters for instance, always also more or less injures beneficial and neutral ones, it is necessary that the public be sufficiently educated in using a trap to know what they are mostly catching. The Bureau of Entomology was created to promote entomological knowledge in its broadest sense. For the U. S. Entomologist to deliberately lie by telling Members of Congress wishing to get at the truth I am wrong on every point means to humbug the people with their own good money, and the Chairmen of the Congressional Committees of Agriculture, Senator Thomas P. Gore and Representative Ashbury F. Lever, full well know this.

An insect might be highly injurious with no official satisfactory means of control known, might be nightflying but be repelled by bright light and even avoid diffused light. Naturally

electric lights and even lanterns giving forth a mild clear light are out of question as traps in this case. To a lesser extent this then holds good also of a dull reddish-yellow light such as is given forth by a torch. If for a killing agent kerosene in an open pail be used then there is little chance, because of the offensive smell, that any such insect would be attracted. but if instead there were emanating from the pail an inviting sweet smell suggesting attractive food to be found only somewhere near the light given forth by such torch, this might alter the case radically, and may often offer the only feasible means of control.

An insect that, as far as official means of control are concerned, meets these conditions is the lesser cornstalkborer, described in Department Bulletin No. 539. This insect has a very wide range of food plants. These include corn, cowpeas, crabgrass, Johnson grass, Milomaize, sugar cane, Japanese cane, sorghum, beans, peanuts, chufa, turnips, and wheat. The infested territory covers a quadrangle marked by Southern California, Florida, Massachusetts and Iowa. It has in this territory an average of four generations a year, and the average number of eggs deposited by the females in 190. In substance the Bureau of Entomology has nothing to suggest in the way of control than "cleaning up" and the plowing of fields. "The borders and the terraces of the field should be gone over with a harrow to stir up the ground," This breaks up the winter quarters of pupae and causes them to perish" (p. 24). The insect breeds and hibernates to a very large extent in what the Bureau habitually calls waste land. To "clean up", these "waste places" is certainly some job,

The Bureau of Public Roads, in one of its more recent publications, Farmers' Bulletin No. 997: Terracing farm lands, points out at length the need of terracing sloping farm lands, by which is meant lands under the plow, while the U. S. Entomologist and his unlearned learned assistants never lose a chance to talk from the top of the bughouse of how to terrrace them. Even where the land is practically level it is necessary to keep the ditches in grass, and the creek- and river banks in

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grass and trees to prevent the banks from becoming undermined and thus, from this source alone, very largely fill up the creek and river beds. Much other details on this very important subject is found in Year Book Separate No. 688: Farm, Forests and Erosion.

Of course, during all of the growing season there can be no such thing as cleaning up. Thus, evidently, the Bureau's system of control is worthless, since while this plan would destroy a small part of this and other injurious insects present during the hibernating period, it does not effect the insect during the period of growth to any great extent, and the policy of "cleaning up" also cleans up the hibernating and breeding places of beneficial insects.

In the case of the lesser cornstalkborer, moreover, we are not at all dependent upon a torch used as a trap. This insect is amenable to control by the free use of poultry. I have been showing for four years past that it is feasible to thus control a great variety of injurious insects. Why use a torch to trap adults, or a harrow to kill pupae over a limited space, when it is possible to use poultry the year around to keep the pest in check and when poultry in doing so secures a large part of its sustenance? "It is seldom that larvae are found in the tunnels of the plants upon which they feed, but more often in specially constructed tubes which lead away from the entrance to the tunnels in the stalk, lying even with or slightly beneath the surface of the ground or sometimes curved around the stem.," Thus you see this insect, as larva, is simply waiting to be picked off by poultry. The moths can also partly be secured by poultry.

However, there are highly injurious insects where the use of a torch used as a trap offers the only feasible means of reducing the number of the species. The European pineshoot moth is a case in point. In this case the adult moths lay their eggs singly into the terminal buds of pine trees, choosing preferably the apical cluster of buds, and in turn cause the leading shoot of the pines affected to become very badly crooked. "...each one of these insects does very considerable damage...

These injured shoots bend downward and outward and afterwards grow upward again in a curve." (Dep. Bull. No. 170, p. 6). The insect shows preference for young trees. In my Circular No. 145, published in 1915, and in subsequent Circulars, I had pointed out that the simplest means of control consists in pouring, at the approach of the egg-laying season in summer, some semi-liquid clay into the apical whorl of buds. This then leaves all the rest of the terminals untreated and thus in normal condition for oviposition. This protection is, of course, feasible only in the case of the smaller trees—unless the Bureau can devise a profitable system of using aeroplanes for this work, and for the reduction of the number of the adults the use of a trap as described—or a better one—is the only thing that holds out hope of success. A trap as described, in this case preferably used with a sweetened decoction of pine twigs, would in all probability, give very good results. The moths might be adverse to light, but the presence of a scent resulting from the evaporation of a sweetened decoction of pine twigs within the pail would be likely to cause them to be trapped. While it does not seem feasible that poisoned sweets, suggested by the Bureau for the control of certain fruitflies, could be used, if they were used, it would have to be found out what other insects, beneficial, injurious or neutral, are thus also destroyed. As the moths prefer nurseries, a trap located there would largely protect more distant, larger trees. All the Bureau has to suggest in the way of control is to first let the insect infest the shoots, then send men through the woods, supposedly fitted with wings or extension rubber necks, and have them remove the grubs and affected buds and burn them, so that other buds left uninfested may make as near a straight growth as possible under the circumstances. This treatment has to be given every year. Moreover there is danger that the moth, in this country, can develop two broods. Fancy what it would cost to examine a square mile of pines even once effectively this way. Yet the Bureau says I am wrong on every point, and the chairman of the Congressional Committee

on Agriculture and prove of this course by doing nothing to force them to make any definite statements.

In his report for 1918 the Entomologist on page 5 mentions the introduction of the European cornborer. This insect is highly destructive and is similar in habits to the lesser cornstalk-borer, and also to the larger cornstalkborer, described in Farmers' Bulletin No. 1025. For the latter insect the Bureau's chief recommendation as to control is rotation of crops, nothing more direct being officially known. It belongs to the same genus as does the sugarcane borer moth. There are 3 or 4 generations a year.

"Fortunately the insect passes the winter in the stalks of its host plants and winter destruction is therefore possible, although winter extermination of its host plants throughout its present range, on account of its numerous food plants, would be a matter of great difficulty and expense"... "Among the cultivated crops attacked in Europe are corn, hemp, hops, millet, several wild grasses and many common weeds. In this country corn is the principal crop seriously injured, but the damage to that crop is so serious as to cause the gravest apprehension should this insect spread into the great corn belt of the Middle West. The caterpillars, of which there are at least two generations annually, bore into the stalk, ear and tassel of the plant. Thirty or more individuals often are to be found in one stalk during the latter part of the summer. ...At present the area known to be infested (located in eastern Massachusetts) amounts to something more than 300 square miles..."

Thus here you have a new pest breeding till it has covered 300 square miles before it is even discovered. How many other, smaller infestations must then be expected to exist elsewhere?

Chief Howard is reported in the press to have told the American Philosophical Society at Philadelphia on April 25 that this pest also got a strong foothold in New York "If this borer reaches the cornfields of the West," he is reported to have said, "I do not see what is going to save them..." The answer is easy. A rope around the little man's hind leg so that he cannot,

as usual, crawfish away before he has made an answer in regard to the method of control I shall describe will save them. And moreover this will lead to a discussion that will save lots of other crops from serious injury, affecting such important insects as the bollweevil and the pink bollworm. The method is essentially the same as described by me for the control of the sugar cane borer moth on pages 32 to 35 of my Circular No. 151 two years ago, in regard to which Chief Howard has not seen fit to make any statement, good, bad or indifferent.

When in 1914 the European pineshoot moth was discovered on Long Island, investigations up to Feb. 9, 1915, showed the insect to be present in nine states with "indications very strong that the pest has become established in several other widely distributed localities." Yet all the while since the Bureau talked about exterminating this insect. It was no trouble at all for the Entomologist thus far to work the public for a sucker. The public sends men to Congress to guard its interests, and if these do not do so, an official of the Executive Department can dish up to a trusting public any old humbug while the dishing up is good.

Of course, in the case of the European cornborer, it is, because of the large range of food plants and the large area even now admitted to be infested, absurd to talk about extermination. Nor can the pest be kept from spreading. Rigid quarantines will impede its progress at great cost. But a sound system of control will make it possible to do away with at least the more onerous provisions of quarantine, and incidentally keep the U. S. Entomologist from lying awake of nights.

Apparently neither the larva nor the pupa in this case is amenable to attack by poultry. Hence the use of a trap as shown, if possible, might be resorted to, if there were nothing better. But undoubtedly the best means of all consists in the judicious use of trapcrops, properly managed, exactly the opposite to what the Entomologist proposes to use. He proposes the elimination of food plants—in this and many similar cases.

In the early spring while all vegetation is succulent the in-

sect is apt to oviposit on any suitable plant near by. Naturally it will prefer sweet corn to common corn, and common corn to most other plants and weeds. Hence the first generation of moths is not likely to be especially destructive to corn. However, since early sweet corn is apt to show a heavy infestation, the stalks should be fed, cut for stover or for silage as soon as the ears are gathered. The bulk of the damage is evidently done through the moths of the second brood congregating upon field-corn. This field corn is apt to have then passed the tassel stage since several weeks and a small planting of corn and, especially sweet corn, just coming into tassel as the second brood of moths appear, would most likely attract the moths very largely away from the main crop grown for ears. The trap crop, if field corn, will not mature properly and should be sown thinly for fodder to allow of the forming of a good many tassels. If sweet corn be used, being smaller and quicker in maturing, it is to be sown correspondingly later. This corn, used for traps, will then very largely concentrate the hibernating larvae, and, by being carefully utilized for feeding, will effectively check the pest.

A pest similarly affecting corn is the pink cornworm, described in U. S. Dept. Agr. Bulletin No. 363. This insect has about 4 generations a year. Nothing in the way of official control is available except early harvesting, early husking and fumigation of infested ears, calling for work at a time when work on the southern farm is most pressing; besides fumigation greatly adds to the cost. Thus the insect is admittedly beyond all official means of control during the period of increase. It occurs only in the cornbelt in injurious numbers, Mississippi having suffered worst thus far. Inquiry in Mississippi, however, shows upon information furnished by State Entomologist R. W. Harned that his State after two years of severe damage is no longer noticeably affected. But serious outbreaks may have been occurring elsewhere right along. It is thought that the decrease in cotton growing, or, what is more likely, the destruction of the bolls in the fall by plowing-in, may have forced this

insect to attack corn with corresponding severity. "...In the young squares (of cotton) ...the active little reddish larva of this *Batrachedra* is very often found as unquestionably an original inhabitant and it undoubtedly frequently causes quite an extensive shedding of the squares. This however, only occurs in the spring... later in the season the *Batrachedra* larva is found boring in the unopened flowerheads of various weeds" (p. 131).

While it is likely that the adult, a moth, can be trapped as described, the fact that the adult oviposits very readily upon young cottonsquares can be taken advantage of to control this pest most easily. When the infested squares fall and poultry has the run of the field, they will attack these and other infested fallen squares for the grubs within. I had explained at length in my Circular No. 152, and as far back as my Circulars No. 147 to 151, that the correct method of controlling the boll weevil consists in the use of poultry in connection with a trappatch of late-planted cotton. This system of control I evolved to cope with the officially admitted tendency of the bollweevil to feed and breed in plants other than cotton, or to go without food and reproduction for long periods by secluding itself in the absence of acceptable food for feeding and breeding, in cool places well protected against heat and cold, thus conserving its vitality. I had shown from official evidence in my Circulars No. 110 to 154 that the conditions in the cage tests the Bureau of Entomology carried on in an attempt to prove what results would happen in case stalks are destroyed in the field at a given date were not normal, and have also shown that where the conditions furnished in the cage did approach normal conditions the survival was much greater than was officially claimed, this work dating back nine years.

Under my plan poultry is to be given the run during the winter of the surroundings of the fields to be planted to cotton, lessening thus the number of the successfully hibernating weevils. When cotton comes up poultry given the run of the field and the surroundings will pick off most of the weevils and many other insects that feed in the tips of the young cottonplants and al-

so pick off many other insects on nearby "wasteplaces" where they aim to complete their first generation to go to cotton in the second generation. As squares form and become infested poultry will attack the fallen squares for grubs. It will readily be seen that this is a continuous check to the multiplication of the bollweevil and permits of the setting of a large amount of fruit. However, to detract the bollweevil, the bollworm and injurious insects in general from the fruiting plants, a small plat, located in the center of the field, about the one-hundredth part of the field in size, is not planted till two or three months after the planting of the main patch. The seed to be used for this trap-patch may be any kind that produces plenty of squares, as far as concentrating weevils and other grubs is concerned, but if seed from the main crop is to be saved for planting, the seed for the trappatch should be the same as that used for the main crop.

This trappatch offers an abundance of succulent squares late in the season, hence concentrates the bollweevil, the bollworm and many other injurious insects, including the pink cornworm to be there continually attacked by poultry in fallen squares and also, in a measure, as adults. The bollworm goes to hibernate in the ground and a plowing before emergence of the moths begins in the spring, but preferably a few weeks sooner because of other insects present, disposes of it. As virtually all this was pointed out to the Bureau of Entomology as long as 3 years ago, you see it is expensive for the people to allow themselves to be humbugged with their own good money by electing men to Congress that let such things go on even if their special duty is to prevent them.

In this connection it will be well to consider the difficulty encountered in the control of fungus diseases affecting plants in general, and cereal- and forage crops in particular, under the methods advocated by the Bureau of Plant Industry, especially as recent press notices announce the presence of a new wheat disease, said to be caused by a fungus, in Illinois, the area in-

fested being given as 100,000 acres. Giving this as the area infested simply means that there exists no definite knowledge as to how great the infestation may be outside of this area. In the case of fungi the spread is caused by spores being wafted by wind or carried by insects, birds and other means, and in the case of bacterial diseases spread takes place chiefly through virus being carried by insects.

The Bureau of Plant Industry does not claim to possess any means that are feasible to control, in a commercial way, a fungus disease of a cereal- and forage crop while the crop is growing. During this period several generations of spores are developed, the more or less complete destruction of which would mean a more or less complete control of the disease. There is no record of a fungus disease ever having remained confined to a small area, not even for a short time. The Bureau's means of control in the case of cereal- and forage crops are substantially confined to treating the seed with a germicide and to advocate rotation of crops. This, naturally, often proves to be entirely inadequate. As is well known, fungi, as a rule, do their greatest damage during a period of continued heat and moisture, and if such periods do not occur most fungi do but little damage without any treatment being given. Consequently any system of control that even holds out merely a slim chance of economically treating the disease during the growing season should have the most careful consideration of the Bureau of Plant Industry.

The essential principle of such a system was discovered and pointed out by me as far back as 1898 in a treatise published at Mt. Vernon, Illinois, and entitled: The Use of the Gasoline Torch in Fighting Insects and Fungi. I showed there that the blast as given forth by a common plumber's torch is capable of licking off the spores of fungi resting upon a leaf; that, therefore, if for instance this torch be used to lick lice and other insects off of cucurbits, involving in this case more especially the treatment of the lower side of the foliage and of the stems, so difficult to reach with sprays. the spores of fungi present are incidentally also destroyed. Previously, in the same year, I had pointed out

that the use of such a torch was far the most practical means then known of controlling the harlequin cabbagebug, an effort on my part in the fall of 1896 to control this pest, then seriously affecting cabbage and allied plants in the latitude of Southern Illinois, having been the direct cause to make me see the possibilities of the use of flame and heat as given forth by a torch in the control of insects. The season of 1897 was given over to investigations in regard to the possibilities of the use of such a torch on insects, and application for copyright of my first treatise entitled: *The Use of the Gasoline Torch in Fighting Insects*—was made on November 8, of the same year, the treatise being published the following spring after tests begun in the fall of 1897 had shown flame and heat as produced by such torch to be capable of successfully controlling the San Jose Scale. I pointed then out that while certain biting insects can be readily controlled by the use of arsenicals, other biting insects and most sucking ones can be far more easily controlled by the use of such a torch than by any other way then known. The chinchbug was then very plentiful, and stress was laid upon the possibilities of the torch in the control of this insect. I pointed out that in cool weather, or during the chill of the night and morning in early summer, the chinchbugs hide largely under the clods near the base of the plant and can be destroyed without affecting at all materially the corn they congregate on upon the approaching maturity of the small grain they infest in the spring.

Soon upon publishing this treatise I found that this same discovery as regards the control of the chinchbug and certain other insects by the use of the plumber's torch had been made also in 1897 by Mr. J. M. Wintfree of Nashville, Ill. I soon realized that a common plumber's torch while possessing the essential principle of control, was not the proper type of torch for an economical application of heat, and in 1903 got out the type of torch shown on last page. It was distinct from any other torch in that the airpump was located in the center of the tank, and the handle of the pistonrod was in the shape of a hook. This pistonrod could be locked by means of a pin against movement.

making it possible, after detaching the shoulderstraps, to hook the apparatus from branch to branch in a tree.

One of these torches was sent to the State Entomologist of Illinois and in the fall of that year he made a report. He would not admit that the torch is the best thing for the control of the chinchbug, claiming in another report that the soil barrier and post hole method, consisting of a furrow that has been pulverized with a log drag and in which at intervals postholes have been dug, was a better method. The chinchbugs cannot at all readily make their way over a finely pulverized furrow. In migrating, under this plan, they fall in, but are not supposed to be able to get out. They are supposed to make their way alongside the bottom of the furrow and to fall into the postholes, there to be killed by the use of kerosene or otherwise.

The U. S. Bureau of Entomology Bulletin No. 95, part III, indirectly condemns this plan in two ways, first by not mentioning it at all under means of control, and second by describing there the log drag method in place of it, condemning the barrier method by the statement that "the block (log drag) must be kept in constant use, from early until late and sometimes well into the night" since "often, during the migration, the bugs travel all night." Another method, the coal tar barrier, is, admittedly, "apparently costly and troublesome," requires freedom from dust, presence of which means renewal of tar barrier "quite often." These matters are discussed at length on pages 27 to 31 of my Circular No. 139. The Bureau admits that with the use of a torch "...generally one blast will cause all the bugs to fall to the ground where they can be burned..." The Bureau thus takes the liberty to quote from my copyrighted matter, and on the other hand, as a royalty, the U. S. Humbugologist tells Members of Congress I am wrong on every point. That's a steal pure and simple.

Moreover a torch used for the chinchbug as described also incidentally enables the farmer to get rid of many other insects injurious to corn, and most of these are not affected at all by either the log drag or tar line method. The Illinois State Ento-

mologist said he had used the torch on woolly bear caterpillars just to find that they recover. He did not take the trouble to cage them and await results. He would have found in that case that they do not survive any length of time. He said little or nothing in regard to the effect the frequent slight application of the blast has on soft bodied insects such as lice.

As to fungus control he said he found that the blast licked off a coating of fungus spores on lilac leaves, but found that spores reappeared in a few days. He thus furnished proof, that the blast kills spores of fungi as claimed, for the spores that subsequently appeared had been thrown out by the mycelium working inside the leaf, showing that the leaf had not been injured in destroying previously the spores that had matured upon it.

Of other torches sent out for experimental purposes one was tested by the Cornell University Experiment Station. Prof. John Craig, as mentioned substantially on page 31 of my Circular No. 139, reported he had destroyed the San Jose scale upon medlars without injuring the cambium, but said this torch is too small to treat orchards, trees being often as high as 40 feet. This is correct. But there is nothing in the way to get up any kind of torch for any purpose, that, too, without interfering with any possible patents. The fundamental principle of the inherent success of this method rests in the cheapness with which the killing agent—the blast—can be produced.

At that time the lime-sulphur spray for the San Jose scale had not come into general use in the Eastern States. This spray went a long way to economically control this pest and also fungus diseases, but as subsequently described in my Circulars No. 139 to 154, especially on pages 11 to 14 of my Circular No. 147, torches can be constructed for orchardwork along the line of tower spraying outfits that will enable several men to attack insects and fungi, and do this work with surprising ease, cheapness and all around efficiency, winter and summer.

For instance California and the Eastern States are now being overrun by the pear thrips. I pointed out in detail on pages

9 to 11 of my Circular No. 147 and elsewhere that where this insect is present in injurious numbers it can, appearing as the adults do at blossoming time, in a few days destroy all prospect of a crop, and thus requires prompt action. I showed that such action by the use of the official remedy, the nicotine-sulphate spray, is expensive and difficult, expensive because the spray in itself is expensive and because under this plan the work must be done within a certain short period, involving the use of an expensive apparatus for a comparatively short time, and difficult because the insect has a large range of food plants and because even a thorough application is usually not a decided success and calls for a second application. One very plain reason for this is that this spray has to be applied with force. This naturally knocks many adults off before they get enough to be killed. I showed that under the method of using heat it is possible to give frequent slight, swift lickings, doing away with the injury often caused by the spray. One thing in this connection the Bureau of Entomology has all along been too bashful to touch upon. It is to what extent a spray given at the blossoming time has upon the fertilization of the blooms.

The use of a torch, unlike the nicotine-sulphate spray, is of particular advantage when the insect is in the larval stage, I showed in my Circular No. 147 that whereas the torch method is the best all around method to control sucking insects and fungi, there is ordinarily no need to make any great effort to attack the adult pear thrips except when swarms arrive from outside sources or when certain kinds of fruit trees and bushes, when in bloom, act as special attractants, or when other insects then present, as for instance the canker worm, call imperatively for immediate action. I showed that as the young larvae develop on the leaves there is a period of about 4 weeks during which it is possible by the application of small amounts of blast to lick off spores and insects. Many, in fact most of these insects drop before they are apparently seriously injured. However investigation would show that nearly all die in a day or two. I showed that whereas a good many larger larvae will drop, it would be well to have

poultry handy by to pick them up. However, I also showed that this is not necessary. I showed that the ease, swiftness and cheapness with which the blast can be applied makes it feasible to lick the ground with the blast, thus disposing of all the fallen larvae.

The Bureau of Plant Industry lays stress upon the need of controlling fungi, and the Bureau of Entomology lays stress upon the need of controlling insects, and the two of them show you many killing agents and many apparatus to meet the requirements for applying these killing agents under the many varying conditions that occur. At the same time the Bureau of Plant Industry extolls the blessings of proper landscape gardening around the home, of proper flower-gardening around the home, of the home fruit garden, and the home vegetable garden, all of which means growing a great variety of vegetation from tall trees, down to grass.

As in a general way each plant has its insect- and fungus enemies, if tall trees are affected these trees in home grounds usually are not accessible to the heavy power-spraying outfits these Bureaus recommend, whereas with or without the help of a ladder as may be suitable, you can treat tall trees with the type of torch shown on last page. You might have some cabbages affected with worms. These usually can be killed easily with arsenicals and, if no other trouble is present, this is a very good, if not the best way. But these cabbages, or your melons, or peas, or rosebushes might be infested with aphids or other sucking insects. In that case under the Bureau's plan, you have to use some of their contact insecticides. If onion thrips, or other thrips, pear thrips for instance, is present, under their plan you have to know how to make and apply nicotine-sulphate solutions; and for fungi other stuff, depending upon whether it is the dormant or growing season. Whereas the use of a torch as shown on last page serves all these manifold purposes far more easily and cheaply, than any other method under the circumstances. If the Bureau of Plant Industry and Entomology do not want to admit this, let them go ahead and show why.

On pages 39 to 41 of my Circular No. 151 you find an account of how torches can be constructed largely out of fittings such as would make up a tower blast torch outfit, that will make it possible to apply heat to insects affecting cereal- and forage crops that require a contact insecticide as does the spring grain aphid or the spinach aphid, detailed information being given on pages 12 and 13 of my Circular No. 144 and elsewhere. The Bureau has no feasible means of control, whereas it is easy to fit up a cart or some light automobile truck with a tank supplying gasoline under pressure and feeding any desired number of burners. And this same method at the same time destroys the spores of fungi that come in the way of the burners, thus keeping down the fungus diseases affecting these crops.

As for freeing the seed grain of fungus spores this can also be secured by the use of a blast, by letting the seed slide slowly down over a wired screen and letting one torch, or, better, two or more torches from different directions, play upon the seed, thus licking it clean. This does not injure its germinating qualities and costs only a small part of the Bureau's plan.

There are several important other insects mentioned in the Entomologist's report that call for consideration here. Of new pests there is the Japanese beetle, mentioned on page 5. It is a very general feeder having thus far been recorded from a total of 41 plants. "The insect attacks the ends of sweetcorn and in the movement of green corn to market can be scattered to various parts." "It appears that the beetle was brought into this country in shipments of Japanese iris during the summer of 1911. ...Some 625 acres are now heavily infested... and it is scattering found over some 7000 to 10000 acres, with outlying infestations over not less than 25000 acres... The immature stages are passed in the soil where the larvae feed on decaying vegetable matter. The adults appear by midsummer, continuing until cool weather in the fall. During hot days the beetles are strong fliers, which adds much to the danger of their spread..."

Let us see: 25000 acres is about 39 square miles. A circle with a radius of $3\frac{1}{2}$ miles would about include this area. Thus

the Entomologist wants us to believe that in about 7 years with the beetles strong fliers during hot days the pest had kept anywhere within this area and he speaks at that of "an attempt at eradication" when the pest is probably spread over a far greater area and when it breeds on many cultivated plants and weeds including grape, apple, cherry, buckwheat, sweet potato, and corn, and with the list now incomplete.

The beetles seem to expose themselves to view during day time, hence on low growing crops could be secured by poultry and the fact that the larvae feed upon decaying vegetable matter in the soil means that they are hidden on the top of the soil right below that layer of decaying vegetable matter where they, and also the resulting pupae, can be readily found by poultry. In addition there is reason to believe that during warm dark nights the adults swarm and are attracted to a torch used as a trap in conjunction with a bait and could be easily trapped.

There is, however, yet another and a very efficient means of control. It consists in concentrating the adults to tassels of late sown corn, especially sweetcorn. As "the insect attacks the ends of sweetcorn" there is in the first place, no good reason why, with the preferred food supply short as the insect becomes more generally distributed. it should not attack readily field-corn. But with the beetles strong fliers during hot days from mid-summer till fall, it will, with corn a favorite food plant, be possible to attract the adults to tassels of late-sown corn, especially sweetcorn, when such tassels are in the pollination stage. A little such corn sown two weeks apart so as to provide tassels from mid-summer till fall will decidedly concentrate the beetles. If this corn be then rolled down, poultry given access, could do the picking off, otherwise it has to be done by manual labor.

The U. S. Entomologist is now likely to right away shout: "Theory." He has done so before time and again when a member of Congress wanted to be shown both sides of the issue. As a matter of fact, in a similar case, as far back as 21 years ago I had shown that while there is no better way to combat the immature stages of the harlequin cabbage bug than the use of a hot-

air-blast torch and while it is an insect feeding normally only upon cruciferous plants such as cabbage, turnip and horseradish, the adults congregate largely, especially during hot weather, upon tassels of sweetcorn and can there be picked off by hand or by the judicious use of a blast, approaching them going backwards to cover them quickly and effectively with the blast. The Bureau has since then published the statement that the use of a torch is effective and practical in all stages except the egg, giving no credit to me for priority, this action constituting a deliberate infringement of copyright.

In practice this happens to be of but little consequence, because as a matter of fact I have since then devised a much better way of control. I showed that, in as much as the immature stages congregate upon the under side of the leaves in colonies and have to be looked after separately involving much time, a much better way consists in concentrating the adults, in plain view for action upon them. This can easily be done, if only care is taken that some cruciferous plants are allowed to bloom and seed at intervals during the growing season. The adults will then congregate upon the seedheads, and poultry given access will pick them off, making the control of this highly injurious insect in a way automatic.

Plainly sound as this method is, it, with all else I have ever written, according to the U. S. Entomologist, is all wrong. The Bureau of Entomology was created to promote entomological knowledge in its broadest sense.

"The so-called grape mealybug has become troublesome in parts of California... This is a difficult insect to handle, since it secrets itself under shreds of bark where sprays cannot reach it readily" (Ent. Report 1918, p. 2). Yes, sprays such as the Bureau has been using cannot reach it readily, but a blast from a hot air torch can do it easily and cheaply, and it was shown to the Entomologist for many years that this is so in the case of many insects that are similarly concealed. Moreover the grape is subject to several troubles that cannot be nearly as well handled with anything than a torch. A blast from a torch is the

very best means to control the grape leaf hopper. During the early part of the season before breeding is well under way it is just under these shreds of bark that the hibernated hopper seeks protection against cold and wet, at which time an application is most effective. Again, even in the drier sections of California the growers have to fight fungus, in this case the kind known as *Oidium*. The blast of a torch licks off the spores of this fungus and does away with the much more expensive use of sulphur, now relied upon to relieve this trouble.

The alfalfa weevil is on page six shown to have extended its range considerably, as usual, and on the other hand is credited with being held in check "materially" by important natural enemies. I had shown on page 11 of my Circular No. 151 from D. A. Bulletin No. 107, p. 57, that, given the chance, poultry is the best possible control measure imported or otherwise, and this would then work also on most other alfalfa insects, including grasshoppers.

Finally on page 9 of his report the Entomologist speaks about 'sweetpotato weevil eradication and control.' This insect has recently been discussed by the Bureau of Entomology in Farmers' Bulletin No. 1020. Records as there given on page 8 show that the weevil was present near New Orleans, La., as far back as 1875 and at Manatel, Fla in 1878. It appears, serious damage did not occur to any great extent until recent years. This, considering the long time since its original introduction, brings up the question of food plants. "...the insect breeds exclusively on sweet potatoes and closely related plants such as morning glory and bindweed..."(p. 16). The "closely related plants" include the whole botanical family of Convolvulaceae. Under Figure 5 is shown a Florida beach being overrun with the beach morning glory. to give a little idea of what job it is to carry out the proposed means of control by "keeping down volunteer sweet potatoes and all plants of the morning glory family, cultivated or wild" (p. 24) In Figure 6 is shown a "corner of a vacant lot in southern Florida, showing mat of wild or volunteer sweet potato vines badly infested by the sweet potato weevil."

There is every reason to believe that the damage to cultivated sweet potatoes has become pronounced chiefly because the wild food plants have become more and more excessively infested. To eradicate the wild convolvulacae, granted it were feasible, simply means, aside from driving the then there existing weevils to cultivated sweet potatoes, to make that much room for some other plants that may breed insects or fungi affecting some other crop. It will be found to be indefinitely more feasible to keep these convolvulaceae reasonably free of the weevils when you stop to consider what poultry on a large scale can be reasonably expected to accomplish. This all the more as sweet potato vines are apt to become infested by the mealy bug, and especially as the territory known to be infested by the sweet potato weevil is largely infested by the Argentine ant, which, as is well known, fosters these insects. With this ant capable of breeding anywhere in rotting vegetable matter, and preferring, whenever available, the excretions of aphids and coccids to all other foods, you can readily see that the Bureau's plan of using poisoned sweets to control this ant, aside from its many drawbacks cannot begin to touch this pest at large and that control at large of this ant is only possible by a systematic and extensive use of poultry, this all the more as poultry in small numbers cannot hold its own against the ant, since the ant attacks the hatching chicks, which in turn proves that poultry is by nature an enemy of the ant, as claimed by me as long as four years ago in my Circular No. 147. pp, 26 to 28.

Of course it is very good practice, as recommended by the Bureau, to have, if otherwise practical, pigs eat up the remnants of the sweetpotato crop. Also there is little doubt that arsenicals early in the season are helpful as claimed, but unless the uncultivated convolvulaceae are taken care of, there is every reason to believe that with a female liable to lay as many as 300 eggs and four generations a year, there will as the wild food plants become more and more heavily infested, be a constant heavy dispersion from these wild foodplants to cultivated crops, and that if the wild foodplants are kept reasonably clear by the

use of poultry, the cultivated plants are kept easily free by the use of poultry also.

"Weevils in all stages may be found in buried roots along the gulf coast during the winter" (p. 5). As it is the top part of the root that is infested, poultry can readily get at the weevils by scratching. "The red and yellow colors of this insect on the metallic blue background of the body are undoubtedly of a warning nature." Hence, possibly, poultry might be cautious about attacking the weevils. There appears to be no good reason, however, why they should not readily eat the larvae and pupae. "...The larvae on hatching tunnel through the vines to the roots, the vines die and frequently the roots become badly riddled and filled with excreta, imparting such a bitter taste that even swine will not eat them,..." (p. 12). Which counts against the use of swine, but poultry is apt to find these larvae to be choice morsels.

Should poultry not do this work sufficiently satisfactory, or not be available, the use of a hot air blast applied with some such torch as shown on last page will prove of more benefit than anything else that can be used in the way of artificial control. In that case the operator will find it expedient to carry a stick in the left hand to raise and move the vines a little, exposing the weevil to the direct blast. Incidentally this treatment to that extent keeps down other insects, and is especially of value against insects that require a contact insecticide spray, which, with vines, is exceedingly difficult and expensive to use.

It can be put down as an axiom that the rate of spread of an insect is controlled by its food- and breeding supply. Thus in the case of the bollweevil official tests have shown that hibernated weevils upon touching young cotton without squares moved only 0.35 foot per day; and I was able to show from an official test, that even after squares had been set: weevils do not move more than necessary to secure squares, in one case an infestation beginning at about the time of the setting of squares having been confined by August 6 still to a small area, evidently because of the small number of weevils causing the original in-

festation in that case. Yet with uninfested squares more or less completely absent, the weevils have been known to readily pass over non-cotton-producing territory 40 miles wide without difficulty. Hence while the sweet potato weevil apparently is a weak flyer, there is no reason to expect that in case of insufficient breeding material on wild plants, it would not assiduously hunt for the more suitable cultivated sweetpotato plants that may have been kept protected in a way by the use of arsenicals, and find them even if they should be a good many miles away.

Contrary to a statement on page 20 of this Circular Senator Thomas P. Gore and Representative Asbury F. Lever are no longer chairmen of the Congressional Committees on Agriculture, having with the majority in Congress passing to the Republicans been superseded by Senator Asle J. Gronna and Representative Gilbert N. Hangen.

According to the U. S. Entomologist I am wrong on every point. Naturally he will not want to agree with me when I say the country owes him for his extra work done as humbugologist at least a six month's course of treatment at some first class penitentiary to get the humbug bacillus out of his system. In any case, I do not propose to worry my head off. If the Governors of the states chiefly affected, their Officials in charge of Agriculture and their State Delegations to Congress do not want to take any interest in the matter, I simply shall bide my time till the public has of the U. S. Entomologist's humbugology had its fill.

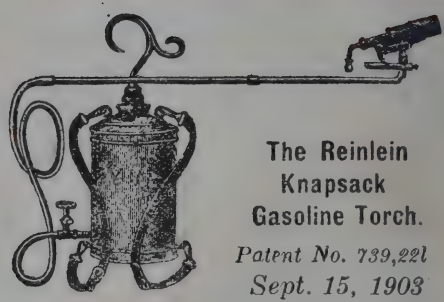
Under date of December 16, 1918 Secretary of Agriculture Houston handed to the Governors at their meeting at Annapolis, Md., a lot of sugarcoated talk about the beauties of co-operation in matters agricultural, but all efforts in the past to get him to order Chief Howard to discuss the issues involved were futile.

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Patent No. 739,221
Sept. 15, 1903

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**The Control of the
European Corn Borer
and of the
Sugar Cane Moth Borer
Circular No. 156**

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By Fred Reinlein

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no. 156

The Control of the European Corn Borer and of the Sugar Cane Moth Borer

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Portland, Oregon

Circular No. 156

September, 1919

IN DESCRIBING on pages 24 to 28 of my circular No. 155 a method of controlling the European corn-borer I had for a basis to work on only such knowledge of the life history and food habits of this insect as could be cleaned from an account of this insect as given in the U. S. Entomologist's report for 1918, p. 5. Now that recently Farmers' Bulletin No. 1046 has appeared, and gives a much more detailed account of the habits of this insect, it is possible to describe a much more detailed method of control.

cost
What renders this insect officially as "probably the most injurious plant pest yet introduced," (Farmers' Bulletin No. 1046 p. 2.) is the fact that it cannot be attacked by stomach and contact poisons, that it has a very wide range of food plants, and that officially practically no means of control are known other than the destruction of the quiescent insect during the hibernating season in these host plants.

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The insect up to April 1919, was known to infest 320 square miles in eastern Massachusetts and about 400 square miles in the vicinity of Shenectady, N. Y., together with "portions of the counties of Montgomery, Schenectady, Albany and Saratoga" (No. 1046, p. 5.) Of course there is reason to believe that if an insect cannot be detected before it infests such large areas, we shall find a goodly number of smaller ones in the future elsewhere, and for the Bureau of Entomology to talk on page 23 about "Methods of Control and Extermination" is manifestly biting off more than they know they can chew. This all the more when one considers under what varying conditions the insect hibernates. Besides corn "the borers commonly attack a great variety of other plants including celery.

Swiss chard, green or stringbeans, beets, spinach, oats, potatoes, tomatoes, beets, turnips, dahlias, chrysanthemums, gladiolus, geraniums, timothy and several different species of weeds and wild grasses, including barnyard grass and wild hemp" This would indicate that they can hibernate in a number of perennial weeds and grasses. "Burning, in order to be effective, all parts of the plant must be burned, including the stubble and upper part of the root" (p. 23). When the plants are green the difficulties in burning them are vastly increased" (p. 24). My experience is that green plants do not burn altogether, 'much less down to the upper part of the root. "Any method of control in order to be effective in permanently reducing the numbers of the pest, must destroy at least 98 per cent of the borers present" (p. 23). "To suppress this pest burn or otherwise destroy all cornstalks, cornstubble, crop remnants and stalks of garden plants, weeds or wild grasses likely to harbor the overwinterwintering borers" (p. 2.). Note: "likely to harbor." Plowing under is officially claimed not to be effective, hence not recommended. But there is very little doubt that cornstubble plowed down deeply and evenly, and the land worked in the spring only in the upper-crust, as for instance for seeding oats, can be thus far more safely, and of course much more cheaply, disposed off than by "plowing them out, raking up in piles and burning them" (p. 23) ". . . . It is probable that the borers would feed upon almost any plant if forced to do so in order to survive" (p. 21). At that rate unless you "burn or otherwise destroy" almost any plant to the ground or parts of such plants, as cornstubble, because it is "likely to harbor" the pest, you will be far away from securing a destruction of 98%. Many of these infested plants to be destroyed are near buildings, fences and woodlands, that may be dry like timber in the fall, liable the only time they would burn, nothing to say about the green infested plants they harbor. This burning, having to be followed year after year, would in a few years destroy all humus, consequently every year lowers the quality

of plants the soil can support, ending in final sterility, lack of food for birds, and lack of hibernating places for beneficial and neutral insects; it would result in erosion on a most gigantic scale, would result in awful floods with consequent filling up of reservoirs and river beds with sediment, and at other times in most aggravated lack of water. "The insect with which we are dealing seriously, threatens the corn-growing industry of this country and . . . radical measures must be adopted for its control" (p. 24).

Since the official means of "control and extermination" is palpably unpracticable and inadequate, we must get the U. S. Entomologist, and Senator Gore and Representative Lever of the Congressional Committees on Agriculture, by the wool and have them define what is wrong with the method of controlling this insect thus far described in my Circular No. 155, and to be now redescribed more in detail, for they could not see anything good in anything I have been dishing up to them for years. This course is radical enough, and means money in the people's pocket especially of those in the States of Massachusetts and New York.

In the territory at present infested in Massachusetts, the borer passes the winter as larva in the tunnel made in its host plant during the previous summer and fall, resumes feeding as warm weather begins in April or May, and becomes full grown usually about the middle of May, then changes to pupa and after two weeks emerges as moth during the first week of June. These moths mate, and a female of this first brood of moths lays an average of 350 eggs in masses of from 5 to 50 eggs each. "The moths prefer to deposit eggs on corn bearing a tassel or just coming into the tassel stage" (No. 1046, p. 26). You there also find an account of very early sweetcorn having been planted near Boston about April 1st, having reached the tasselstage early in June and become severely injured, while corn, planted 10 days later was injured to a lesser extent, and plantings made about May 1st, were nearly free from injury. It is pointed out by the author, in substance, that if no sweet corn had been planted before about

May 1st, little or no damage would have resulted to corn, since then the moths would have oviposited upon other plants bearing a green seed head, generally some of the weeds or grasses." Sweet corn planted in the first half of April in Massachusetts is altogether too uncertain and too limited a quantity for the moths to rely upon to deposit on, but this experience shows, that the moths of the first brood congregate upon corn "bearing a tassel, or just coming into the tassel stage," if available, and that, unless infestation can be prevented, this corn will be rendered about worthless, if the borers are at all plentiful and the supply of host plants comparatively limited.

If to avoid damage no sweet corn is planted up to May 1st, and the moths are allowed to oviposit upon any suitable plant they find, there will be no systematic way of getting rid of the borers in the infested plants. If on the other hand the preference the moths show for various food plants other than corn be carefully noted, and a patch be sown of grasses or suitable "weeds," for the chances are that the "weeds," make valuable feed when cut young, or a mixture of both as are most likely to effectively concentrate the moths, this patch might be mowed close to the ground, cured and baled before any moths of the second generation are ready to emerge. This plan pays for itself; hence can be generally adopted and if need be enforced in a community way, and if so carried out would alone be enough to so check the pest, as to protect the corn crop against serious loss. Naturally, early sweet corn, under this plan not likely to be at all heavily infested, after the ears are gathered should be fed to stock. But this is far from being all that can be easily done to minimize the pest.

"Generally the borers enter the stalk at its upper end near the base of the tassel. . . ." (No. 1046, p. 9). This evidently is the ideal place of oviposition. But with a large number of moths present, the moths of the first generation laying an average of 350 eggs, and those of the second generation an average of 550, the inclination of so ovipositing cannot always be followed. Moreover when the moths of the second brood emerge during the last week of July, the main

crop of field corn is normally further advanced than that, hence "many of these eggs are deposited directly upon the newly developed ears of late corn" (p. 19).

The problem is to prevent the deposition of these eggs upon these ears and upon these corn plants generally. This can be done by sowing corn as you would for fodder, but thin enough, and at such time, that it will show the greatest practicable number of tassels at the period the moths of the second brood appear. This patch of fodder corn will then be offering the most suitable oviposition material and consequently act as a trap and draw most of the moths away from the corn grown for ears. Millet carrying seed stalks might be an ideal crop for this purpose. Milomaize and sorghum should be tested especially as the pest is bound to find it way to the drier sections of the South West.

The moths, in common with all other moths, of course do not partake of any solid food. On page 17 of my Circular No. 155, you find proof to show that the codling moth, having been exhaustively studied, is known to readily, even greedily, partake of sweetish substances such as juices exscenting from cracks in ripening sweet summer apples. In the case of most other moths, nothing definite is known on this point, purely through lack of investigation. But the sum total of the evidence available on this point is to the effect that, if not all, at least most of the moths hunt for sweet substances such as nectar emanating from glands, especially on flowers, on many plants, or for sweet smelling juices that promise to furnish liquid food.

Suppose a crop grown for ears is in such attractive condition for the moths of the second brood of the European cornborer, that, ordinarily, no trap crop would draw them away, and this would happen quite likely if the period of fertilization were to coincide with the swarming of the moths, then if the moths are fond of such sweet smelling juices, such juices located within the area occupied by the trap crop would, to a certain extent at least, draw them away, localize the infestation and through using the crop thus grown for feeding

before emergence of the first brood of moths begins in the spring, the pest receives another severe check each year.

In a section where the insect is capable of producing 3 to 4 generations, the use of trap crops has to be carried further, substantially as described in the latter part of this Circular for the control of the sugar cane borer moth, which produces 4 to 5 generations, and has a very similar life history and food habits.

Again, most night flying insects, and the European corn borer is night flying, show a tendency to fly to light. This tendency in the majority of cases is slight, while with some species it is very pronounced. Light used in some way with some suitable sweet smelling attractant necessarily gives a combination with results better than by either agent used alone.

On pages 17 to 20 of my Circular No. 155, I have shown in detail an original way of making this combination of furnishing light and sweet smelling juices. The apparatus shown on last page, or one of similar construction, is suspended on a tripod, or, possibly, a convenient tree, at such a height that the light given forth by the torch comes slightly above the top of the surrounding vegetation. In the case of corn the tripod might be made of 3 pieces of clear lumber 1 x 2 inches 16 feet long, or a pole of proper height provided with a bracket on top, set in the row, might be used. After hooking the lighted apparatus at the apex, or hoisting it up, hose, pipe and burner, are allowed to hang down perpendicularly. Since no strain is wanted to come on the hose the weight of the pipe and burner is carried by a piece of rope fastened at the outlet from the tank. A pail is hooked onto the burner. Originally some water and kerosene was put into the pail and this completed the arrangement. This caused large numbers of insects of certain kinds to be caught. However, it was also found that many others that might have been trapped did not get trapped. I showed thereupon that if there be fitted into the top of the pail a spitton cover like piece of tin, this will help to trap insects after they have been knocked temporarily silly

through bumping against the red hot burner in the semi-darkness. To increase the efficiency of the torch further there was also to be fitted over the burner a lampshadelike cover of tin. A space, about $1\frac{1}{2}$ inches for general trapping, was to be left between this cover and the top of the pail. This left a circle of light of any desired width through which the insects were to be admitted. The narrow space in the chamber thus created, the sudden change from darkness without to light within, the red hot burner and the heat and the circle of light contracted to as little as will readily admit the insects to be trapped, make it naturally next to impossible for any insect to get away again. Under this plan no water and kerosene is needed since the insects once they have dropped through the hole in the center of the spittoon coverlike fitting are kept in through the blast blowing down upon this hole. They thus necessarily quickly succumb, in fact are gradually burned up.

Doing thus, away with the need of kerosene as a killing agent is an advantage, because the smell of kerosene acts as a repellent. This makes a very much better trap for insects that markedly love light, but many injurious insects do not love light sufficiently to pay much attention to it, hence fail to be caught in paying number under this plan. In any case wherever kerosene was used in tests, investigations have shown that mostly males are caught, and that what females are caught, have mostly laid their eggs. Nor is there reason to expect that the mere doing away of the smell of kerosene would materially alter the case, as far as securing a greater number of fresh females is concerned.

But the case is essentially altered if instead of kerosene and water there is used in the pail molasses and water, or anything suitable for special purposes to give off a pronounced inviting smell suggesting the presence of liquid food. In this case newly emerged females will try to get at it in the hope of thus hastening eggmaturation. But the food they hunt after, under this plan, is only accessible through entering

the chamber in which is the burner, and this means almost certain death to them.

The kind of bait that had best be used would vary with the food the insects it is primarily intended to trap normally live on. Thus for a corn insect, sorghum molasses is likely to be most efficient, for an apple insect, some decoction of sweet apples is apt to prove best, while cucurbit insects will respond best to ripe crushed cucurbits or the foliage thereof.

Hence under this plan, suppose the European cornborer moth were not only not attracted to light, but were actually repelled by it, and there is a small percentage of such insects, then the presence of water and molasses in a pail as described kept steaming by the blast blowing down upon it, and thus producing a pronounced sweet smell, would tend to draw the moths away from the field of corn grown for ears to a field serving as a trap. Even if not a single one of the moths were caught, the torch would thus, through causing the moths to oviposit chiefly on the surrounding trap-patch, accomplish all that is necessary for the control of this insect at this period. The trap-crop, preferably corn, is to be utilized preferably as silage, which disposes of all the borers within, while if the fodder be cured, what comparatively few moths might emerge in the spring from uneaten parts, are taken care of next spring in connection with those moths that have developed on plants other than those grown for traps the previous fall.

The question is, what is known about the attraction trap-lights have for the various species of insects. Far the most detailed account we have on this point, is given in Bulletin 202, of the Cornell University, Experiment Station, Ithaca, N. Y., compiled by the late Entomologist, M. V. Slingerland. This Bulletin is now out of print. As the matter is of national interest, it would be well if a re-print were authorized, chiefly for the study of official Entomologists. What is of interest in it for us to know just now, is, that the record of one trap-lantern run from May 20, to October 1, 1892, given on page 207, showed a total catch of 12712 insects. Of these, 4716 were "small moths", contributing 37 per cent. These small

moths are on page 209 shown to be "mostly undeterminable," but consisted chiefly of species of the families of "Geometrids, Pyralids, Tortricids, Tineids," made up of about 50 species. Now the ~~the~~ European corn borer moth belongs to the family of the Pyralids and the sub-family of Pyraustids. In an appendix, now long exhausted, and of which the University went to the trouble of sending me a typewritten copy, is given a detailed account of the more common insects taken in a test using 6 trap lanterns, scattered over the University Farm, and we find that, supplementing similar information given on pages 210 and 211, as also in the forepart of the appendix giving details in regard to a trap test in 1892, there were caught of Pyraustid moths as follows: **Loxostege sticticalis** (garden web worm), total taken 83, males 66, females 17, one brood, August. And: **Nomophila noctuella** (rarely a pest) total taken 109, males 89, females 20, probably 3 broods, time, August. Thus the number of females taken averages about one-fifth of the total taken, indicating that with a kerosene smell about the light the females attend first of all to egg-laying, and that if some inviting smell were present they would be likely to frequent the location where the smell emanates especially before egg-laying begins in hopes of facilitating egg development. This is borne out by tests in trapping codling moths with apple-jelly, recorded on page 19 of my Circular No. 155. In that case about half the codling-moths caught were females. The trap-lanterns referred to above were plain lanterns set on a brick in a large pan containing water and kerosene, mounted on a stake.

The use of a torch as a trap in the control of the European corn borer is to be looked upon as an auxiliary means only, and intended to come into play if for one reason or other the use of trap crops cannot be, or has not been, employed. But then the torch traps other injurious insects also. In eastern Massachusetts, the flight of the second brood of the European corn borer moth coincides pretty closely with the flights of the brown tail moth and that of the gipsy moth. Indications are that the period of flight of the second brood of the

European corn borer, is not well defined, and extends over a period of about 6 weeks. The height of the flying season of the brown tail moth is at about July 12, while that of the gipsy moth is at August 1. The brown tail moth is an insect strongly attracted to light. So are the males of the gipsy moth. If the Bureau of Entomology were to test out this trap as described, they would find it traps the brown tail moths in enormous numbers. The light of a torch cannot compete as attractant with the light furnished by electric lamps, and these, if the globes are closed, trap nothing, but with a sweet smell present the torch would work right in the glare of the electric lights in the case of all insects attracted by such sweet smell.

The brown tail moth is so decidedly attracted to light, that the adults largely congregate and lay their eggs in the vicinity of strong lights about towns, villages and farms. I pointed out repeatedly that if this habit were properly taken advantage of this would be far the cheapest way to keep the pest at large down when requiring artificial control, which in the range of light it always does, and usually also out of that range. I also claimed to possess a workable idea along this line. However, as the U. S. Entomologist has been for over 20 years allowed to have a free hand in throwing official influence against me, it was far better for me to salt that idea down and leave the field open to him and to those that want to hitch up to him. As the case now stands, a trap as described will, because of the sweet smelling attractant provided, work within the range of strong light, and answer very well. Thus here you have a trap, that during day time destroys insects and fungus spores through application of the blast, explained in detail in my Circular No. 151 to 155.

If all the "waste places" were cleared by "burning or otherwise," this would largely destroy the hibernating parasitic and predacious insects, largely imported, and about the usefulness of which those in charge have been shouting themselves hoarse for the past 10 years or so.

There is another auxiliary means of controlling the

European corn borer. This is the use of poultry. During the resting season infested grasses and weeds will break or bend at many points infested, and poultry given the run will get a large part of the borers. As far back as 4 years ago, and throughout my Circulars No. 147 to 155, I showed that the use of poultry as insect destroying agents, can be greatly extend, that under the supervision of man they could be used to roam farm and forest, that, considering conditions in eastern Massachusetts in the case of the gipsy moth, they can secure a large part of the eggs, can secure a large part of the moths and also a large part of the caterpillars, for they can secure most of the caterpillars on low vegetation before they develop poisonous hairs and can secure also a large part of these on the trees through the habit of these caterpillars while young, as also of the brown tail moth, to suspend themselves on silken threads going to the ground.

Two other important corn pests of similar habits—the larger corn stalk borer and the lesser corn stalk borer—infest most of the eastern U. S., and the methods described in this Circular are adaptable to them also.

The sugar cane moth borer is an insect possessing a life history and food habits very similar to the European corn borer. Like the European corn borer it belongs to the family of Pyralids, but differs in belonging to the sub-family of Crambids. The pest has been doing serious damage in Louisiana as far back as 60 years ago and all the while efforts were made to evolve a satisfactory means of control. The system of control now advocated by the Bureau of Entomology is described in Department of Agriculture Bulletin 740, recently issued. The recommendations are summarized on pages 62 and 63 as follows:

1. "Scraps of cane left about factories should be destroyed by burning or otherwise" Of course as long as there is no effective way to secure control of the borer during the growing season this plan must be followed,

since otherwise, if the infestation was heavy, it certainly means a heavy emergence of moths.

2. "Cane should be planted in the fall" All very well. But it must be planted late enough to keep from sprouting and this usually cannot all be accomplished in the fall.

3. Cane for shipment to points beyond the infested area should be free of borers."

4. "The trash should not be burned, but should be lightly covered with earth in the fall and plowed out in the spring. This practise has never been found to increase the borer infestation" But you read in this same Bulletin, page 8: "Westwood states that . . . the borer was very destructive in Jamaica . . . but its ravages had been greatly checked by allowing the refuse to accumulate on the ground and then firing the whole plantation" Also in Louisiana Experiment Station Bulletin No. 70, series 2, page 893 you read: "I was once troubled with borers . . . for six or eight years . . . I buried as much cane tops as I could. The crop . . . was one-third short . . . my neighbors who had not buried, but burned their cane tops were not affected at all. Since then I have burned the tops and I found very few canes now affected by the borer."

Anyway burning impoverishes the soil. Also it destroys beneficial parasites developing in the trash. But these parasites cannot be safely relied upon, for they themselves are apt to be minimized by hyperparasites or perdaceous insects, and at best they mean only partial control.

5. "Cutting out 'dead hearts' or dead plants and destroying them is theoretically sound, and with an abundance of cheap labor it might be recommended." Foxy. Everybody knows that an abundance of cheap labor at that busy time is purely imaginary. Theoretically under a Government, of the People, by the People and for the People all a man evolving a new method of insect control has to do to bring his method effectively before the People is to ask the Official

Entomologist to render a decision as to the merits or demerits of the case. But such is not the case with the U. S. Entomologist. The U. S. Department of Agriculture has been created to promote agriculture in its broadest sense. Hence even with the Entomologist merely passive, if the method have value, he is against the People. The U. S. Entomologist says I am wrong on every point, refusing at the same time to prove his contention.

5. The introduction of parasites of the moth borer from Cuba and other tropical countries is recommended."

These means of control are entirely inadequate if you consider that the borer has 4 to 5 generations and "allowing 200 eggs for each female . . . it is found that each pair . . . is capable of producing, (in the fourth generation) 202, 020. 200 borers . . . Something of its enormity may be realized by considering that if the offspring of one female were confined to one acre, there would be over 10,000 borers per stalk of cane . . ." (D. A. Bull. 746, p. 30). In other words, should one fertile female escape in spite of the artificial and natural means of control quoted—and the borer breeds and hibernates also in a number of wild grasses including Johnson grass—one female would be enough to stock a whole township.

Consequently it will be not asking too much to expect His Deafness, the U. S. Entomologist, to lend an ear, willing or unwilling, to any proposed means of control that is new and has at least some chance of success.

The system of controlling the sugar cane borer moth I am about to describe is essentially the same I described on pages 32 to 35 of my Circular No. 151, and is re-described on page 9 to 12 of my Circular No. 154, also on page 7 of Circular No. 155. "It rests upon the habit of the moth to prefer young corn to cane, at least late in the season, and as originally described provided for successive trap rows of corn planted at monthly intervals from March 1st to say, September 1st. As the earlier sowings of corn mature the borer breeds in the later ones, and these are successively utilized for fodder, stover or silage, before any great number of moths has begun

to emerge from such traprow or traprows.

The total evidence available tends to show that as the moths emerge in the spring they oviposit indiscriminately upon either cane or corn. However as corn is, early in the season, more rapid in development, there is no reason to believe that if corn be planted near to places of emergence such as the borders of the field, or where cane had been winrowed, they would oviposit to any great extent upon cane. ". . . . The moths while existing in small numbers confine their attacks to the ends of the rows and to the ditch bank rows . . ." (La. Exp. Sta. Bull. No. 70, ser. 2, p. 903). If so, this tends to prove that the chief infestation comes from a source—food plants growing wild along the borders—that is not considered to be important at all by the Bureau of Entomology.

"... Very late corn is often ruined by the ravages of the larvae, the moths from the earlier corn and from cane depositing their eggs in the young corn plants as well as on cane." (D. A. Bull. 74 6, p. 53).

From this you will see that it should be feasible to devise a system of attracting the moths to successive plantings of corn and checking the increase of the pest by proper management of these plantings. It is evident, in the case of the late corn referred to, that if it had been cut and utilized for silage while partly grown, this would have effectively checked the borer. Also, if a still later planting had been available, this would then have become the favorite place for oviposition later on.

Under average conditions 4 plantings of corn at successive dates spread over the season should be enough to effectively protect the cane. We might make the first planting, for ears, on April 1st—say a strip 25 feet wide. Then by May 15th, we might plant another strip 25 feet wide, also for ears. And plant another strip of same width by July 1st. This third strip, if its is to serve as protection against borer increase, cannot be allowed to mature, hence had best be sown rather thinly for fodder. Thus as corn planted April 1st gets too tough for oviposition in June-July, there are two

younger patches within easy reach inviting oviposition. A fourth planting is to be made August 15th. The first and second planting make the crop ears wanted on the plantation for hog and hominy." The third sowing might be cut for silage to best advantage by about September 15th. Any moths emerging can oviposit on sowing No. 4. With borer increase severely checked by using the third sowing for silage in September, the fourth sowing will, ordinarily, effectively concentrate the pest. This last sowing has to be used in any way desired before emergence begins in the spring.

Considering that there are 4 to 5 generations of borers, it will be readily seen, that in years of abundance there should be 5 or 6 plantings, with correspondingly shorter intervals and a longer total trapping season. All these plantings of corn can and should be sown to a winter cover crop preferably a hardy legume. A strip of a total width of a hundred feet, divided into 4 to 6 smaller strips, makes possible the use of any machinery that it might be desired to use for handling the crop. Such a strip of corn would readily well protect a strip of cane 500 feet in width and to only a slightly lesser extent a strip of 1000 feet.

It is obvious that such a schedule of trap patches brings the borer under absolute control. Consequently, as this method of control resolves itself simply to a specific form of sound farm management and therefore is the cheapest possible means of control, there is no need to point out any auxiliary means of control that may exist. Reference to two will be made, however, because they are useful, if not necessary, in controlling other cane insects.

The moths resulting from the hibernated larvae of the moth borer oviposit on young cane or corn. In a considerable number of cases this results in "dead heart. In that case: ". . . . The central portion or 'heart' of the plant is dead and the dying of the rest of the plant is only a matter of days." (D. A. Bull. 746, p. 5). 'Dead heart' also results through other insects and other causes. Now for about 4 years I have been trying to call the attention of the U. S. Entomolo-

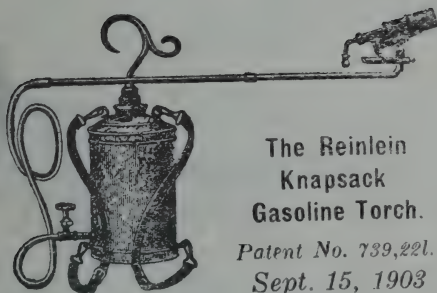
gist to an "abundance of cheap labor" that is available, and which labor is simply hungry for a chance to go to work, and that is found in the use of poultry. A young plant that dies down is very likely to be scrutinized by poultry for grubs, since a bend suggests a juicy grub at a point readily opened, hence the employment of poultry will thus cause a reduction. Also poultry can be expected to secure a part of the moths. I had pointed out as far back as my Circular No. 147, 1915, that the use of poultry is a necessity in cane fields, because of late years ants are greatly helping to increase the numbers of the sugar cane mealy bug, and poultry would eat the ants. Then poultry will also get many other cane and corn insects, some of which will be difficult to control some other way, explained on pages 4 to 8 of my Circular No. 155.

The use of a torch as a trap in connection with sweet smelling substances could, if we had no better means of control, probably be also developed into a fairly satisfactory means of control, judging from evidence given on pages 45 to 47 of Department of Agriculture Bulletin 746, which shows that the borer moth is to a certain extent attracted to light. The inference is that if sweet smelling sweets are added, the attraction is much greater. In the tests there recorded the devices for trapping were expensive and ineffective. To illustrate: One device consisted of a huge gasoline burner producing a flame 5 to 6 feet high. "... . The moths would fly near the flame, their wings would get singed and they would drop to the ground" This would not ordinarily prevent a moth from laying as yet more eggs. Whereas, in the case of the torch, as previously described, what light there is emanates from a small chamber and there is darkness without, making a combination as dangerous as it is harmless looking.

It is hoped Senator Asle J. Gronna and Representative Gilbert N. Haugen, the new chairmen of the Congressional Committees on Agriculture will give this matter proper attention.

It is to be hoped that Senator Asle J. Gronna and Representative Gilbert N. Haugen, the new Chairmen of the Con-

gressional Committees on Agriculture will give this matter proper attention by having the U. S. Entomologist either admit that I am right or else specifically show why I should be wrong.



The Reinlein
Knapsack
Gasoline Torch.

*Patent No. 739,221.
Sept. 15, 1903*

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JUN 28 1922

On the Nature and Control of the White Pine Blister Rust

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Circular No. 158. Date of Final Printing, April 19, 1920

WHAT is claimed by the Office of Forest Pathology, of the Bureau of Plant Industry, to be a correct analysis of the nature of a disease killing white pines is given under the above name in Farmers' Bulletin No. 742, written by Dr. Perley Spaulding. The disease is there claimed to be "caused by a parasitic fungus" (p. 1).

In my Circular No. 152, pp. 26 to 32, issued in 1918, I showed that the disease that really kills the pines is bacterial in nature, and that what parasitic fungus occurs on the pines is merely the hibernating form of a fungus affecting currant and gooseberry bushes in summer, and I claimed that if the currants and gooseberries were eradicated, "the disease that is killing the pines is there as before" (p. 28).

I tried to get Dr. Spaulding to criticize the evidence I submitted, but in vain. I then made the same effort with several State Pathologists that had done research work in this line. Of these Pathologists, only Prof. F. C. Steward, of the New York State Experiment Station at Geneva, made a reply. Mr. Steward, with Mr. W. H. Rankin, had gotten out State Bulletin No. 374: "Does *Cronartium rebicola* over

winter on the currant?" M. rSteward stated: ".... I prefer not to make any statement concerning the pine blister rust except to say that your theory as to the nature of the disease is entirely incorrect."

"Since the white pines of the United States are estimated to be worth \$423,000,000 and those of Canada \$200,000,000 additional it is felt that no chances of a further spread of the blister rust can be taken" (Farm Bul. No. 1024, p. 25). Thus since the Bureau of Plant Industry professes to be wanting to serve the interests of the public, they ought to be eager to criticize the more complete evidence in support of my claims I am now going to submit.

The life circuit of the white pine blister rust fungus as understood and illustrated by Mr. Spaulding in Figure 4 of Farmers' Bulletin No. 742 is just what I claim it in my Circular No. 152 to be—the circuit of a fungus affecting currant leaves in summer and hibernating on diseased parts of pine in winter. No reference is made in Figure 4 and accompanying text to pycnidial drops and to pycnosporos living in them, nor to their appearance before the spring form of the rust, the peridermium spores, appear on the swollen or already cankerous bark.

Unsupported theory enters through Dr. Spaulding claiming on page 11 that these pycnidial drops are merely indicators of the disease, meaning by the disease the rust fungus, but understanding by rust fungus in this case not merely the circuit formed by teliosporos lodging upon pine in the fall and generating peridermium spores on pine in the spring and these

peridermium spores generating uredospores on currants, and these uredospores by late summer generating teliospores on currants as given in Figure 4, but also wanting it understood that the canker killing the pines is caused by these forms of rust; in other words Dr Spaulding wants it understood, that the swelling of the diseased parts and the formation of pycnidial drops is merely incidental to the life circuit on pine of a rust that in summer lives on currants.

On the other hand I not only put up the theory that these pycnidial drops serve a purpose, but also showed that they have nothing to do directly with the life circuit of the rust fungus, since they occur both "early in the spring or they may occur apparently at almost any season in late summer and fall" (F. B. 742, p. 11). I showed that as the fungus disease is in summer admittedly absent from pines, the origin of pycnidial drops "with immense numbers of tiny sporebodies" (p. 11) occurring during summer and fall on pine cannot be ascribed to the rust fungus, I having originally specifically pointed out that there are then no teliospores present to produce them, since these only occur in the fall.

"What the function of these tiny spores "(pyncospores, living in the pycnidial drops)" may be nobody knows. . . . They are simply indicators of the disease" (p. 11). Talk about theory. First, Dr. Spaulding says, nobody knows what they are, and then he claims to know what they are. Not only this, but he expressly claims they have their origin through the hibernating form (teliospores) of the rust fungus "The teliospores, falling upon bark of suitable age on a white

pine, may in turn germinate, penetrate the bark and grow in the inner layers during the incubation period already mentioned" (p. 14). The incubation period lasts without outward sign from less than a year to 6 or more years (p. 11). "This infection of the pine bark must take place in the late summer of fall. If the parasite "(the teliospore)" finds conditions very favorable, it may produce the sweetish drops of liquid with the pycnosporos early the next spring and shortly after that it may produce the blisters containing the peridermium spores. . . ." (p. 14). This is on a par with saying that a potato planted for a crop can, for an indicator of a crop, first hatch a chicken—for I shall show that the pycnosporos are microbes, which are considered to be of animal life—and then later, for a crop, produce a bunch of tubers.

As stated before the life circuit of the fungus admittedly does not require any pycnosporos to complete it. Then how is Dr. Spaulding to prove his claim that teliosporos produce the pycnidial drops, with the pycnosporos they contain? Not only can he not prove his contention, but it can be shown that a teliospore falling upon previously diseased bark produces a blister of peridermium spores in the spring and nothing else. This, I have to admit, was not very clearly shown in my Circular No. 152. I merely there stated that as the pycnidial drops containing pycnosporos occur besides in the spring also "apparently at almost any season in late summer and fall," it follows they cannot be caused by teliosporos, as these are just then forming upon currant leaves and are blown

to pines by the wind, requiring development within the bark before they can produce anything.

That the bark must be already diseased before a teliospore can sprout on it, is shown, in addition, by the fact that the teliospores produce the peridermium spores only in certain places, shown to be diseased by a swelling or a canker, whereas these teliospores are blown by the wind all over the tree, as would snowflakes for instance. Hence, if they could sprout on sound bark, peridermium spores would appear on all of the bark of suitable age in the spring. And having thus shown that teliospores sprout only on diseased bark, this means they cannot infect sound bark to start the disease that produces the diseased bark, which proves that we have to do with two distinct diseases, as claimed, one which we will call and which really is a bacterial disease—the disease that really kills the pines—and another, a rust fungus, living in summer on currant leaves and in winter on pine bark, diseased by a canker in various stages of development. The teliospore is credited with having started in some cases the disease as long as 6 or more years before it becomes outwardly visible through swelling of the bark and the appearance of pycnidial drops. But no proof whatever is given that a spore of a parasitic fungus ever could do such a thing. But then “The life history of this parasite is very complex” (p. 11), according to Dr. Spaulding, after giving in Figure 4 what he declares to be, and in reality is, the life circuit of the causal fungus of the white pine blister rust, a circuit of fungus as can be “paralleled by a great number of related fungi” (p. 11). I would appreciate

having one or two of such most closely related fungi specifically mentioned.

The trouble affecting the pines can be explained therefore in a perfectly satisfactory manner only by assuming that the pycnospores are microbes similar to those contained in similar exudations occurring in pear blight and other cankerous diseases, that they are carried by insects, or possibly birds, or other agencies to bark of suitable age on other pines and by stinging or rasping or possibly merely smearing are thus given access to the tissues. It is hard to see how there can be much proof to show that the disease was present a specified time, such as 6 or more years, before swelling of the bark made it apparent. There appears to be no record that a fungus can cause such swelling, but there is ample record that microbes can. This swelling, it is reasonable to assume, is due to congestion of diseased sap and the pycnidial drops are the natural result. The pycnospores therefore must be assumed to be a form of low animal organism working in the tissues. This is further indicated by an examination of Figure 4 and Plate I which show very little swelling left by the time the peridermium spores appear. Each peridermium spore cluster there shown is clearly the result of a successful infestation by one teliospore the fall before, each cluster developing independently of the other. An examination will show that these peridermium clusters cannot apparently utilize any great amount of sap; to all appearances they merely utilize as much sap in comparison with their size as do uredospores and teliospores, the summer and fall form of the rust, on currant leaves.

The text accompanying Figure 4 claims in part: "... The late summer stage . . . infects neighboring white pine which may and may not include the pine which bore the blisters that started the outbreak the preceding spring." Now "... No tree infected with this disease has ever been known to recover. . . " (F. B. No. 1024, p. 23). Hence you here have an admission that a tree may not have been re-infested with teliospores the fall before and yet in any case remained diseased the following summer. This proves that destruction of all currants and gooseberries within range of infection does not stop the disease that kills the pines.

It does not follow from this that there is no connection between the presence of currants and gooseberries and the spread of the bacterial disease that kills the pines. There certainly does seem to exist a connection. The insect or other agent that carries most of the pycnidial fluid to other pines may be attracted by the blooms of currants and gooseberries and later by the fruit. Or the insect may be predaceous upon the currant aphid. Or it may be parasitic upon the currant worm. Removal of currants and gooseberries would then tend to keep the insect away. On the other hand once some pines produce pycnidial drops there is no reason to believe that since these pycnidial drops are attractive to insects on their own account mere removal of currants and gooseberries everywhere would prevent all future infection.

Since therefore we must look upon the removal of currants and gooseberries near white pine as a step likely to reduce the degree of infection, the question of how this is best

accomplished is to be considered. "Various chemicals and sprays are being tested in the hope of finding a cheap and practical means of killing wild Ribes. The results obtained indicate that dip oil, fuel oil and possibly sodium arsenite can be used economically to destroy dense growths of Ribes where the cost of hand pulling is excessive" (1919 Report, Bureau of Plant Industry, p. 39).

Nothing cheaper or more practical for killing wild ribes will be found than a light, longhandled pick ax, one end pointed and the other with a one or two-inch transverse cutting edge. This allows of grubbing, cutting, yanking and pulling, all without any hand pulling, except possibly some torn off roots that might otherwise sucker.

Substantially this same course holds good in the present campaign for the removal of barberry bushes, a plant that is necessary as an alternate food plant in the spread of the black stem rust in latitudes where the summer form of rust cannot hibernate. "The number of localities in which wild bushes are found is immensely larger than was believed.... the seeds having been sown in large numbers in thickets and woodlands by wild birds. The difficulty of locating such bushes in rough and broken timberland, oftentimes amid thickets and underbrush will be appreciated by any one who undertakes it...." (1919, Report, Bureau of Plant Industry, p. 33).

The difficulty of removing will be still more appreciated than that of locating if it is to be done by the official method recommended and shown on page 1 of Farmers' Bulletin

No. 1085 as: "The proper way to remove barberry bushes. Dig deep enough to get all the roots." A bush about 4 feet high is there shown, on smooth ground and isolated, as being dug out with a spade. It is false to claim that you need all the roots. You do need all of the surface roots. The roots going down can be cut off below the root stock. An attempt to work a spade in a thicket on a 12 foot bush would result likely in cutting some top roots to pieces, causing suckers. In thickets, or with bushes growing among heavy clumps of grasses or among rocks, a pick ax with usual length of handle, one end pointed and the other cutting one or two inches transversely will first tear the surface roots off, they to be pulled out then whole by hand, and the taproots, which do not sucker, can then be cut or yanked off, making work very thorough and comparatively very easy in the most difficult situations.

This then removes one of the best food plants the wild birds have and means corresponding decrease in the abundance of the birds, or else a necessity on their parts to make up this loss on cultivated crops.

If a man is able to show nothing further than that the cankerous disease that kills the pines exists independently of the fungus rust affecting leaves of currants and gooseberries in summer and hibernating on diseased parts of pine, he has shown something of great value to the forest interests of the country especially in the infested territory and still more so in the territory infested by the gypsy moth. It means that the removal of currants and gooseberries, en-

tirely, or within certain zones considered safe by the Bureau of Plant Industry, does not result in stopping all spread of the disease that kills the pines as claimed by the Bureau. It means that as long as a satisfactory way to reduce the numbers of carriers of pycnidial fluid yet present after the currants and gooseberries have been removed is not found, planting white pine is virtually certain to be money thrown away.

No satisfactory remedy is in sight or likely to come in sight, hence it is clear that the interests of all the country at large demand that the public be told the truth. The Department of Agriculture is created and gets each year a nice handful of shekels to promote agriculture in its broadest sense and not to humbug the people with their own good money, or at least with part of it. Moreover this matter is entirely independent of the many other issues relating to insect and fungus control on which the Department of Agriculture has during the past 22 years been too bashful to make any statements, a matter discussed in my Circulars No. 155 to 157.

"Moreover, within the area worst affected by the gipsy-moth, the forests are being converted into white pine" (upon the advice, or at least with the knowledge, of the supposedly learned and honest men of the Bureau of Entomology, that want to shut their eyes so the fact, that the European pine shootmoth is now there to ruin what might escape the gipsy-moth) "as rapidly as possible, because this species is far the most valuable one which is not seriously injured by this insect. More than this the white pine, in many sections at

least, is much the most valuable tree now available for future forests. Its loss would be a real catastrophe, for no other tree can take its place" (F. B. No. 742, p. 6).

"Many of the so-called hard pines, having leaves in twos and threes, have been exposed to infestation in Europe but have never taken the disease. . . ." But the planting of hard pines cannot unconditionally be recommended either, because of the presence of the European pine shoot moth, which by preference attacks the apical bud and causes crooked and stunted pines, for the control of which moth the Bureau has no feasible means of control. A proper system of control has been described by me as far back as 1915 in my Circular No. 145. A short description is given on pages 5, 17 to 20, and on page 22 of my Circular No. 155. It consists in pouring some semi-liquid clay before oviposition begins into the apical whorl of buds. The moths then oviposit on the lateral branches. This use of clay is feasible only on the smaller trees. To protect the trees at large a system of light trapping by using some such torch as shown on last page in conjunction with certain fittings and a steaming sweetened decoction of pine twigs was described by me in Circular No. 155. No official action was taken, this system of trapping having been evolved during the past 5 years. It has been pointed out to the Bureau of Entomology that such a trap would be of value in controlling the gipsy moth in woodlands by trapping the males. The Bureau was all the more urged to test this matter out, as I wanted to get fair treatment before I would describe a device I have in mind that will take care

of insects that go to electric lights. For the present there is nothing better available in this case than a torch trap, same as to be used in the woods, to be mounted near such lights and to be used in connection with sweet smelling substances as described in Circular No. 155.

In addition I pointed out as a means of controlling the gipsy moth that the woodlands could be made to support large flocks of poultry, that poultry could pick there the largest part of their keep most of the year, and could secure young caterpillars of the gipsy moth through the habit of these caterpillars of letting themselves down to the ground sometimes, could secure and eat as many of the large caterpillars that crawl down the trunk towards morning to hide near the base as they can stand, could find and eat eggs on or near the ground and could find many of the females hiding on the ground or on the underbrush during the day. I showed that poultry could thus also keep down many other insects and could fatten largely on acorns in the fall, and that with these means of control available it is all wrong to advise the suppression of oak in favor of planted white pine.

Having shown that the disease, which kills white pine and which furnishes in bark thus diseased the means for completing the life cycle of a rust affecting currant leaves in summer, is caused by a low animal organism similar to that causing pear blight, what means are there for its control?

" . . . The disease may kill the largest tree"
(F. B. No. 742, p. 6). "The blister rust first attacks the twigs of a pine tree and then gradually works into the larger

branches and the trunk" (F. B. No. 1024, p. 23), "... an old tree ... is likely to have everyone of its lateral branches as well as the top center shoot, attacked and finally killed" (F. B. No. 742, p. 6).

It is evident that the disease is spread by some agency such as an insect or a bird picking on the pycnidial drops and carrying the pycnospores to other pine. A tree grown for timber and subject to various diseases and insects throughout its life cannot stand much expense for treatment at anyone time. Hence the most feasible means of control seems to consist in trying to destroy or keep away the carriers from the pycnidial drops. These drops, when the disease is well established, will be usually out of reach. It is not even likely that it would pay to give special attention to each tree where these drops are within reach once there is general infestation. However one such means for smaller trees I pointed out on page 31 of my Circular No. 152: "... the most feasible course consists in taking a little white pine—or other handy evergreen branch and slap this about the infested parts of the pines and do this while the pycnidial drops are present, especially in the spring. It would seem certain that this causes the pycnidial drops to dry up, thus killing the microbes they contain. . . ." A further suggestion: Where the canker is near the ground, soil might be ridged up to it. If too high, soil dug with a spade and thrown into the branches and sticking to the canker might help to dry up the pycnidial drops. With an evergreen branch these drops could be brushed off when occurring at considerable height. I repeat I do not think

it could be made to pay.

It must be borne in mind that pines thus affected by the disease, because of their weakened condition, invite borers and that at present there is no practical official means of control for these. The official means advocated is the removal of infested trees while dormant. Thus in one of two pine trees, located about 1 1-4 miles from the New York State Experiment Station and traced through infecting currants near by to be the source of rust infestation on currants at the station, Mr. Steward found borers working. These borers could be trapped in large numbers by the use of a torch trap as previously referred to. In doing this the presence of other insects present—injurious, beneficial and neutral—must also be considered. The Bureau of Entomology never took this matter up, although shown the need in many ways for the past seven years in my Circulars No. 139 to 157. With a proper system of trapping carried on with a view to control insects amenable to trapping in general many trees can be profitably saved that otherwise would succumb.

It might be that the cankerous disease in question is spread by borers and trapping them as fast as possible would then be the most feasible means. If, as is more likely, flies, wasps and bees spread it, there seem two ways open to give relief. First, provide, if possible, suitable food plants that furnish nectar to draw them away from the sweet-tasting pycnidial drops, and, second, if the first course is not possible because of absence of clear land near by, use repellants to drive them away. It should be possible in the majority of

cases to use a barrel spray pump fastened on a pointed stone-boat for the application of some such deterrent spray as crude oil to the trunks of some of the big trees, just enough to render the grove uninviting to the carriers. Or the opposite course might be used: Scented poisoned sweets might be exposed to draw them away from the sweet-tasting drops. Of course it would have to be determined to what extent thus beneficial insects like bees are destroyed. In that case the carriers might be fed on unpoisoned sweets in an effort to draw them away. Young trees might be protected by spraying some kind of rubbish such as straw, weeds, evergreen twigs with some repellent such as crude oil and distribute them over or among the trees.

As for the rust on currants " . . . spraying has not proved practical or successful in preventing infection or in killing the fungus after it attacks the currant and gooseberry leaves . . . " (F. B. No. 1024, p. 24). I quote for a remedy from my Circular No. 152, p. 28): " . . . The fungus disease on currants can easiest be kept down by an occasional slight licking of the underside of the leaves with a hot air blast torch, a suitable type of which is shown on last page. This was pointed out by me as far back as 1898, but the Bureau of Plant Industry never made any tests to satisfy themselves." Such licking would cause the voracious larvae of the two-brooded imported currant worm to drop to the ground to be killed there by the heat at close range. The Bureau of Entomology advises the use of poison. This at best is successful only with small worms and does not go well together with

ripening fruit. Sucking insects like scales and lice readily succumb to occasional swift lickings with a blast.

Another very serious danger now threatens the pines of the East. This is the European pine saw fly. It was first discovered in Connecticut in 1914 and is described in the Connecticut Experiment Station report for 1915. I quote: "This species is one of the most injurious saw flies on European conifers . . . it has a large number of host trees . . . and . . . would do a great deal of damage . . ." (p. 119). It has two broods in Connecticut. In the breeding cages all cocoons (of both broods) were made on twigs. "In Europe, raking up and destroying the leaves and other rubbish under the trees in fall is recommended to destroy the cocoons" (of the hibernating brood). If the cocoons of the second brood are on the ground, there is one means of control feasible—the use of poultry on a large scale. But if the hibernating cocoons are made on twigs no means of control is feasible since the use of arsenicals on timber trees to kill the larvae is out of question. One conceivable means of control would be the attraction of the adults to poisoned sweetened baits, always involving the risk of poisoning many beneficial insects. Also poultry might destroy such larvae as fall down or are blown down by wind, suspend themselves near the ground or crawl over the ground to other trees in case of shortage of food.

This pest may be present in many other places right now, similarly as was the case with the European pine shoot moth after it was discovered in 1914 when it was found within 9 months "in 20 localities in 9 states with very strong indica-

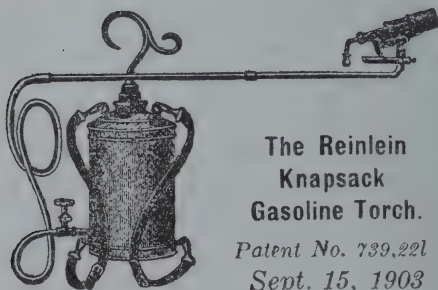
tions of infestations in several widely distributed localities.”

As for the cankerous disease affecting the varieties of white pine the disease will either wipe them out or there will survive some trees entirely or partly immune, the seed from which will finally serve for new stock. In any case this is a bad time for the Department of Agriculture to advise the planting of white pine, the more so now that it has been shown that the disease exists independently of currants, and that there is no promise that palliative measures can be made to pay. It is therefore the plain duty of the Department of Agriculture in this matter to admit that I am right or show why I should be wrong, something they were wanted to do in regard to other issues pending for 22 years past.

What other tree might then be handy to fill the place of pine? In conifers larch would probably best do that. Its chief enemy is the larch sawfly. This insect has been at times very destructive because no official means of control was known. As far back as my Circular No. 149, p. 16, I pointed out, that since this fly is present as larva or pupa in a cocoon on the ground 10 months out of 12, it could be easily controlled by the use of poultry. According to the U. S. Hum-Bugologist this with all else I ever wrote in the matter of insect control is wrong.

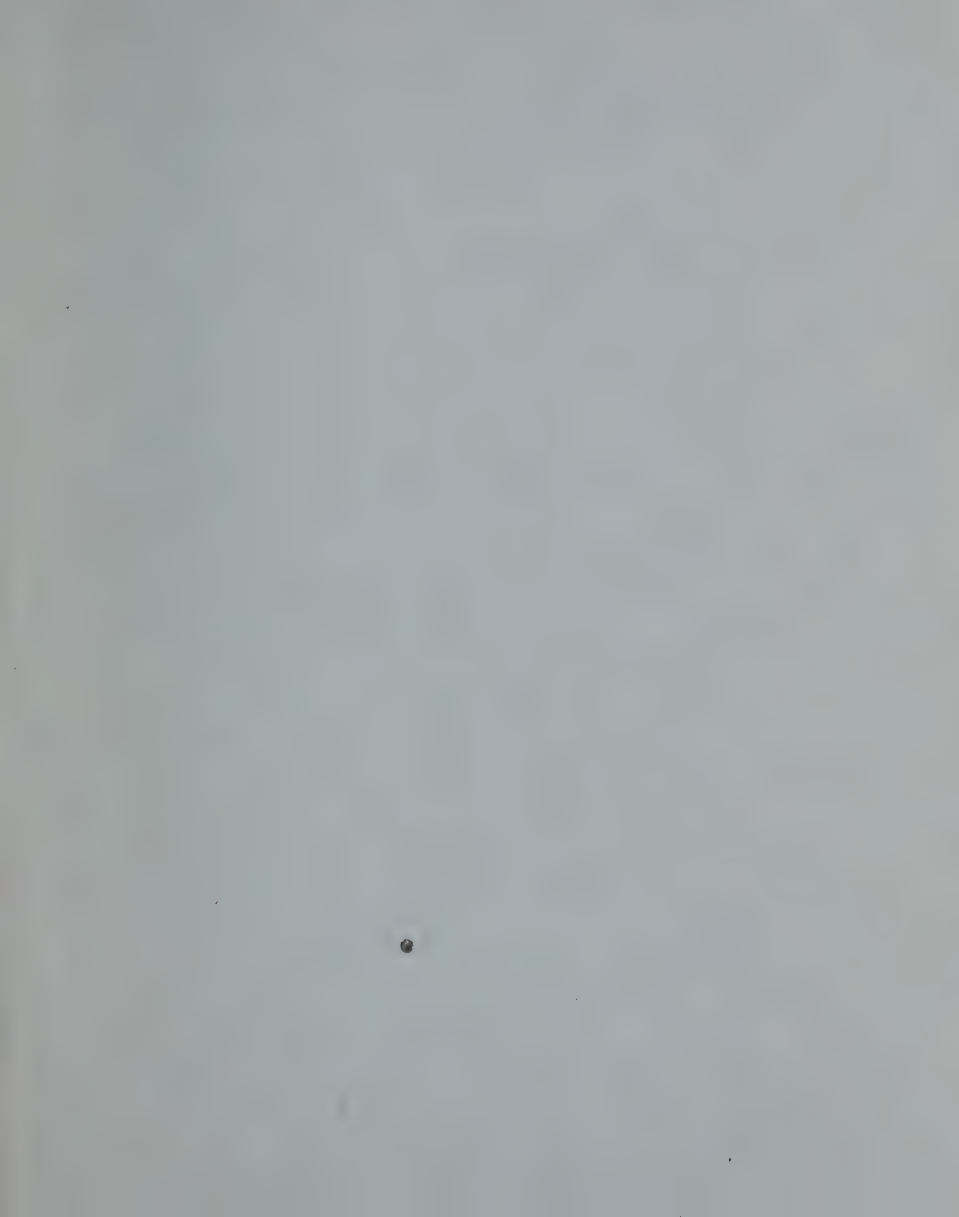
Of deciduous trees the catalpa is one of the best for growing timber. The gipsy moth virtually cannot live on it. It is however attacked by the catalpa sphinx, which frequently causes complete defoliation. There is no practical official means of control, since the use of arsenical sprays for the

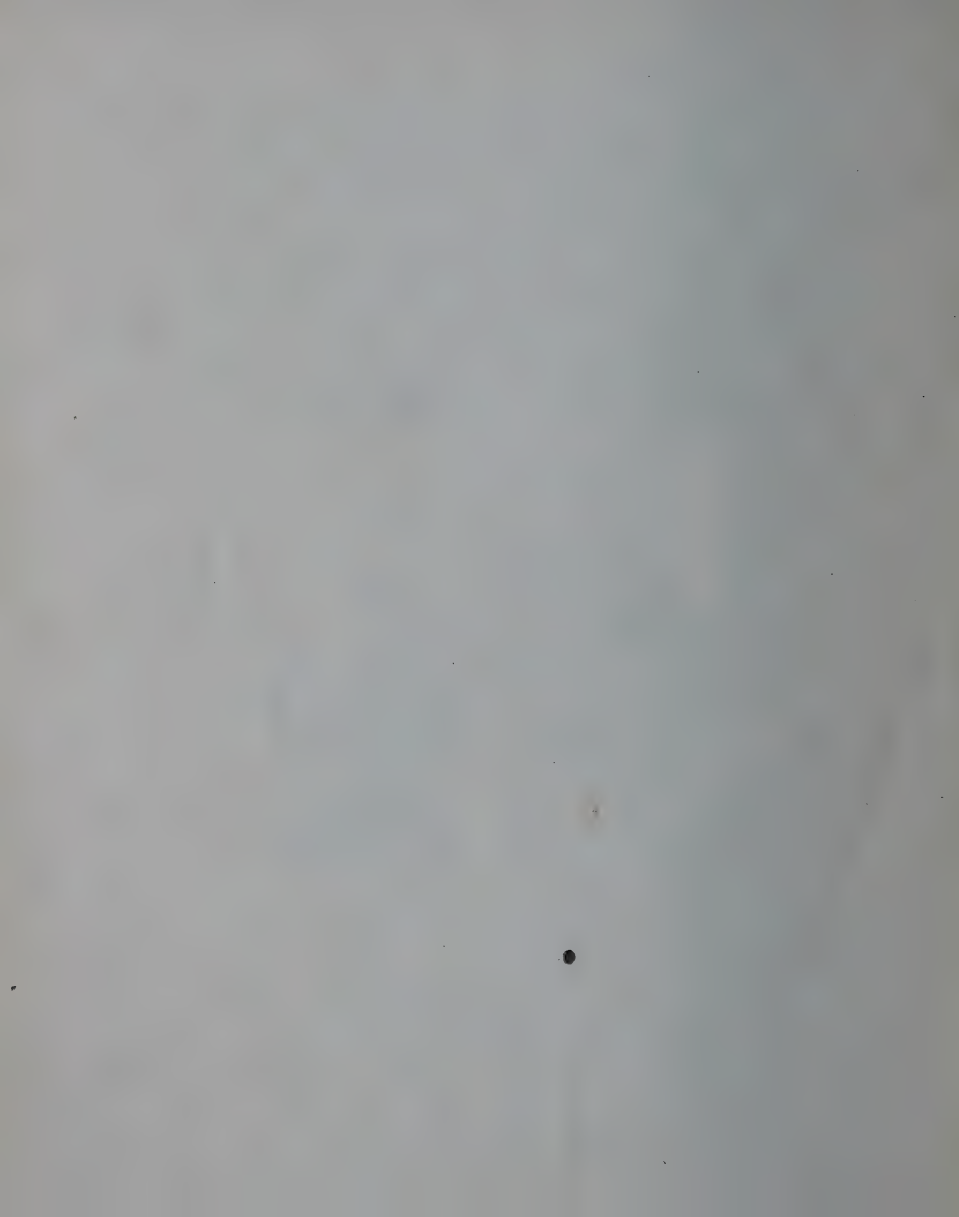
larvae and "to spade up the ground thoroughl yand disintegrate it in the fall so as to destroy the pupae. .concentrated. . . in the immediate vicinity of the trunk" (F. B. No. 705, p. 9) advocated by the Bureau are out of question on a tree grown for timber. On page 8 of my circular No. 149, I pointed out that since the insect pupates in the rubbish under the trees, giving poultry the run of the woods, keeps the pest under control. But the U. S. Bum-Bugologist says I am wrong, thus not only withholding official endorsement of a good method, but actually fighting it contrary to the interests of the people.



**The Reinlein
Knapsack
Gasoline Torch.**

*Patent No. 739,221
Sept. 15, 1903*





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A Study in Humbugology

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Portland, Oregon

Circular No. 159

July 1, 1920

SOON after the Hon. Gilbert N. Haugen became Chairman of the House Committee on Agriculture I made an attempt to convince him of the need of action on the part of the Department of Agriculture on a number of issues pending for years, practically all of which are discussed in my Circulars No. 155 to 157. Pending action Mr. Haugen sent me a copy of a hearing before the Committee last winter on behalf of appropriations for the Bureau of Entomology, which brought out a number of statements on the part of the U. S. Entomologist and his staff in reference to insects just now requiring special attention, and in regard to certain means of control for some of which I had especially requested Mr. Haugen to have the Bureau of Entomology define its position. In the absence of action, this copy of the hearing was examined by me, thoroughly annotated and returned to Mr. Haugen as a help to get action taken on just the points most wanted. However as soon as it was forwarded there arrived a letter from Mr. Haugen, this letter having been sent him by the Department of Agriculture, in which acting Secretary C. F. Mervin practically claims the means for the control of insects and fungi I recommend are worthless, this without giving the

slightest detail in any particular case. Therefore to enable the reader to judge for himself as to the merits of the case I take up a few of the issues, stating the position both of the Department and of myself.

The discussion before the Committee as to what the Bureau of Entomology considers to be the proper means for the controlling of the Japanese beetle in New Jersey offers a good example for a general understanding as to the merits of the claims on each side.

On page 35 of my Circular No. 155 I called attention to the fact that the U. S. Entomologist in his report for 1918 had stated among other things that this beetle is a very general feeder, having up till then been found on 41 plants, including such a variety as grape, apple, cherry, buckwheat, sweet potato, corn, many ornamentals and weeds, as smartweed, morning glory, black locust, ironweed, etc.

According to the Entomologists' statements the insect lives 10 months out of 12 in the ground as a grub and the "larvae feed on decaying vegetable matter." I pointed thereupon out that this means that, as a rule, "they are hidden on the top of the soil right below that layer of decaying vegetable matter where they and also the resulting pupae can be readily found by poultry." Evidently the beetle oviposits by preference in grasslands as do many other beetles of similar habits, May beetles for instance. If then the use of poultry, carried on systematically and on a large scale, was no good, why does not Chief Howard explain? As he did not do so, I call attention to the ways he expects to employ to destroy the larvae,

for Mr. Mervin makes the following claims: "....All of the methods that Mr. Reinlein recommends so strongly have been investigated from time to time by the experts of the Department and none of them has been found to be of any great service except in a most restricted way...." Thus, if the Entomologist has tested out the use of poultry for the destruction of those grubs as claimed, and this systematic use of poultry was described by me as far back as 1915 in my Circular No. 146, let him explain why it did not work with the grubs in the soil 10 months out of 12. What method does the Entomologist use in its place, and which he claims to be better? He uses "cyanide of soda in solution at the rate of 1 pound to 200 gallons of water and applied at the rate of 22000 gallons per acre." That is very expensive. This then kills "most of the larvae." If it does, it means it kills those that are near the surface, where poultry could have easily found them and grown fat at the job. Then again how about the beneficial insects the Entomologist says he wants to set to work. Probably the most valuable ones are the ground beetles, which would probably be as much affected by the poison as the grubs. Then there is probably some danger of poisoning stock, involving at any rate, careful watching. "Weeds along the roadsides have been burned to destroy their food and render such places unattractive to the beetles, thus.... waste-places along ditches and other spots which cannot well be treated with cyanide are being cleared of weeds...." Ditches and roadsides want to be kept in tough sod and burning and "clearing" is destructive to both, because of the resulting ero-

sion. Such a course adopted generally would fill up the rivers and reservoirs with sediment. Chief Howard knows the destructive effect of erosion since I had called his attention in past Circulars to official literature in regard to this matter and often quoted from it, for instance on pages 32 to 35 of my Circular No. 157.

"Plowing the soil infested by the grubs and pupae appears to destroy them. It will be necessary to do this kind of work very extensively in waste places and many areas not under cultivation." Aside from thus increasing erosion, where will there be left any hibernating places for any beneficial insects? Again, this means destruction of cheap pasture and means treating meadows and pastures with cyanide, rendering farming intolerably expensive. Also Chief Howard has a habit of talking about protecting wild birds in one breath, and about burning over "wasteplaces," their natural home, in the next.

"The work of eradication and control has been vigorously prosecuted...but in spite of all that has been done the insect is increasing rapidly over new territory and at the time of the present writing is perhaps 150 per cent more abundant than at the same time last year." Why then talk about eradication at all? When I call attention to such things the Entomologist tells his Superior I am trying to assail the Department.

"During hot days the Japanese beetles are strong fliers." The territory given in the 1918 report is 25,000 acres. Now after the pest has had a rapid increase, it is said to cover only 15,000 acres. "While the beetles are flying a wide barrier of

poisoned foliage is maintained as completely as possible around the whole area of infestation." With an appropriation of 130,000 dollars a year for 25,000 or 15,000 acres you can do a lot of things to buncoe the people with a supposed possibility of eradication, things that are absolutely out of question with the man that has to make the farm pay.

On page 36 of my Circular No. 155 I described 2 ways of handling the beetles. First, while the beetles are dayflying, they probably also fly during the early part of warm dark nights, and in that case can be more or less successfully trapped with a torch, used as a light trap, to be later described in conjunction with the European cornborer. Another method was also described. It "consists in concentrating the adults to tassels of late-sown corn, especially sweet corn. As "the insect attacks the ends of sweet corn," there is in the first place no good reason why with the preferred food supply short as the insect becomes more generally distributed, it should not attack field corn heavily. But with the beetles strong fliers during hot days from midsummer till fall, it will, with corn a favorite food plant, be possible to attract the adults to the tassels of late-sown corn when such tassels are in the pollination stage. A little such corn sown two weeks apart so as to provide tassels from midsummer till fall will decidedly concentrate the beetles. If this corn be then rolled down, poultry given access could do the picking off, otherwise it has to be done by manual labor."

I then went on to show that this is merely an adaptation of a method I described as far back as 1898 to concentrate the

adult harlequin cabbage bugs, and that later on I showed that this bug can best be controlled by providing some cruciferous plant going to seed at intervals during the season, and have the bugs picked off by poultry. The Entomologist lies when he says this method is no good and that the Bureau has a method that is better, for Mr. Mervin has been induced to say "the methods of the Department are without exception based upon careful field investigations by competent experts."

The harlequin cabbage bug has recently received renewed attention on the part of the Bureau of Entomology in Farmers' Bulletin No. 1061. What makes this insect of increasing importance is the fact that it has learned to breed on a large list of cultivated and wild plants other than crucifers, making the old standby in control of it by the Bureau, "clean cultural methods," even more impracticable of effective application than it was before.

Some of these non-cruciferous cultivated plants are: ". . . truck crops of nearly all kinds . . . of which eggplant, asparagus, potato, tomato, okra, beans and beets are most affected" (p. 8). Also: ". . . squash, late corn, grapes, and nursery plants of citrus, loquat, cherry and plum. The bugs are also partial to weeds other than crucifers, including ragweed, pigweed, wild lettuce and lambsquarters. They congregate on all parts of these weeds, but appear to prefer the stems." "The stems" evidently mean the forming seedstalks, these containing the choicest juices of the plant.

Says the Bureau on page 11: "The grower should bear in mind the unusual fondness of this insect for horseradish,

which, being a perennial crop, serves as a natural trap crop throughout the growing season. The foliage of the horseradish should never be neglected so that the insects are permitted to breed on it continuously. . . ." The use of hand-picking and of a torch are recommended. But the bugs on horseradish are largely hidden and such destruction is in reality not what could be desired.

As horseradish, grown for roots, does not bloom, and has no seedstalks where the adults might be exposed to view, why not then see to it to have all through the season some cruciferous crop nearby going to seed, as then the adults will largely congregate in plain view on the stalks, can be picked off, possibly by the use of poultry, and thus the pest in the whole neighborhood be kept down to harmless numbers. This use of cruciferous seedstalks is especially effective when used out of season, that is, when few or none of the cruciferous plants, wild or cultivated, are normally in bloom. Thus a row of stumps of early cabbage, or, still better, of early cauliflower, could be allowed to throw up seedshoots in and after midsummer, purely to act as traps, when few crucifers will be in bloom.

"The large size and bright colors of the insect and its scorn for concealment render it easy to detect . . ." (p. 11), yes, the adults. How about the nymphs? "The eggs . . . are normally placed on the underside of the leaves . . ." (p. 7) and the nymphs, as normally, feed out of sight. Of course the aim should be to concentrate the emerging hibernated adults in the spring. "Throughout the year wild plants of the mus-

tard family should be carefully kept down, not only in the fields, but in the immediate neighborhood . . .” says the Bureau on page 10. A big job, and just what “immediate neighborhood” is to mean the Bureau is wise enough not to say. There is pretty good evidence to show that the adults, on warm spring days for instance, can fly for miles when in need of choice food. A systematic use throughout the season of a specially attractive crucifer in bloom, such as rutabagas, cabbage or cauliflower, through sowing or planting a traprow along some crop likely to attract the pest in large numbers, will concentrate the bugs, and there is no good reason why this picking off could not be done then by poultry, if a little grain is scattered along these trapplants.

“The value of the hand torch for the control of this insect has been proved by experimenters in Texas. . . . Its chief value is in the destruction of the insect on trap crops, although an experienced operator can safely apply it to a garden or commercial field, bearing in mind that only an instant’s contact with the hot flame, i. e., sufficient to cause the bugs to drop to the ground, will so injure them, by scorching the legs and antennae or “feelers,” as to render them harmless and incapable of recovery. The brief contact necessary to accomplish this will not injure the plant. . . .” (p. 12). This is essentially what I had shown to be the case as far back as 1898 and the Bureau all along was wanted to show who it was, if anybody, that described this method before that date.

However this admission, as it stands, means a lot more than what it shows on the surface. If a moment’s scorching

of such a stout bug renders it incapable of recovery, why could not then a torch of some such type as shown on last page lick off for instance the lice or thrips on grains, or why could not a torch outfit be designed to lick off lice or pear thrips on tall trees?

The Bureau on page 12 calls attention to the fact that "in cool or breezy weather" a torch is likely to give trouble and advises the use of a vaporizing coil inclosed in the burner to remedy this trouble. There stands nothing in the way to devise a suitable torch for the use on vegetation of any height and under anything like favorable conditions, as repeatedly referred to in Circulars No. 155 to 158. Naturally strong wind is to be avoided. But it is less of a detriment than in spraying and dusting.

Again I had shown as far back as 1898 that the harlequin bug is attracted to the pollen of sweetcorn. Hence, with the insect greatly extending its range of food plants, certain non-cruciferous plants, grown for use or ornament, when in bloom, will act as special attractants for the adults, as also in the range of the Japanese beetle they will serve to attract and concentrate the beetles.

For concentrating the Japanese beetle rows of millet might be even better when in bloom than sweet corn, making easy picking for poultry.

Thus since neither Chief Howard nor anyone else can prevent further spread of the Japanese beetle, the practical control of this insect resolves itself into the judicious and extensive use of poultry the year around. Instead of contin-

ually advocating the burning over or plowing up of lands not under cultivation, poultry working under supervision of man can and must be made to do as near as possible all the work previously done by wild birds, now with most of the country under cultivation reduced to a fraction of their former number.

Thus for instance on pages 24 to 38 of my Circular No. 157 I was discussing the control of the grainbug and the Mexican conchuela, doing great harm in the dry sections of the Southwest and West. I pointed out from the Department's own literature that plowing and burning and the use of chemicals as advocated by the Bureau of Entomology in Department Bulletin No. 779 destroys the slow growing, drought resisting native grasses and turns the land over to the worst kinds of weeds. I showed that encouraging the development of poultry solves the problem with and without concentrating the bugs to millet or other crops in best condition at certain times. If this use of poultry as described was tested out as claimed, why are not any definite statements made?

A striking case of where poultry proves to be the only feasible means of control in the case of an insect often occurring in enormous numbers was given on pages 13 to 16 of my Circular No. 157. The insect in question is the smoky crane fly. This insect is capable of doing great damage in destroying cereal and forage plants, as many as 200 larvae having been found in an area a little over a square foot. There are many species of this genus present as adults at different dates be-

tween spring and fall. Poultry, it was shown, would get many adults as they oviposit in grass, preferably such as is rank. Then also, the larvae were shown to make small ridges through burrowing just below the surface of the soil, attracting admittedly the attention of birds, hence also of poultry. The Bureau does not recommend the use of poultry. They recommend nothing altogether. They have no remedy. Only in the case of a late ovipositing species they make an attempt at showing a means of control and what do you think it is? It is close grazing of pastures "as the adult flies usually congregate in rank growth of grass, clover, weeds, etc., and there lay their eggs." That is, here the Bureau wants to have waste places handy with rank growth on it, to protect the meadows, the very places they habitually say should be burned over or plowed up. Such places, of course, are the breeding ground for many insects, injurious, beneficial and neutral, but they are the very places for poultry and stock to gain a great deal of their sustenance and thus keep the cost of production down. One should think a man claiming to be an economic entomologist would not need to have such facts hammered into his head. But then there are none so blind as those that do not want to see. Taking this case as an example, it is obvious that with poultry having access, the insect could never become really plentiful.

Under primitive conditions all land was what the U. S. Entomologist calls "waste places." Wild birds and beneficial insects could thrive there and insect outbreaks were then practically unknown. Extensive cultivation furnishes an in-

crease in food plants, and a corresponding decrease in facilities for the multiplication of birds and beneficial insects. Hence, in modern agriculture, poultry must be used as far as possible to take the place of wild birds. Without this, of course, such "waste places" are always liable to furnish an overflow of injurious insects to attack cultivated crops. On the other hand, if a field is cleared, these "waste places," such as headlands and fencerows, concentrate the insects, and it is up to poultry to keep them down. In this way "waste places" are used to protect succeeding adjoining crops against a great variety of insect outbreaks.

On page 16 to 19 of my Circular No. 157 is given a short account of the value of poultry in the control of the New Mexico range caterpillar. Also from Department Bulletin No 124, p. 28, issued by the Bureau of Entomology, is shown that Mr. Chas. Springer of Cimarron, N. M., hires a boy to herd an immense flock of turkeys to keep the grasshoppers down. The Bureau was wanted to show for 5 years past why then the use of poultry for the control of the range caterpillar during 10 months out of 12, when the insect is not in the form of a caterpillar studded with urticating hairs, should be impractical, being as poultry are a domesticated form of natural enemy of insects in general.

About 7 years ago the Bureau of Entomology attempted to establish a calosoma beetle (*C. sycophanta*) in the range caterpillar belt. I pointed out in my Circular No. 146 and 147—the Entomologist calls it a theory—that the attempt would be useless, showed that the insect as larva has to work there

unprotected and exposed to view by birds, and being hairless, is attractive to them, while the hairy range caterpillars are repellent to them. I showed from U. S. D. A. Bulletin No. 251, p. 9, that skunks, raccoons and foxes destroy the beetles, as also do many other smaller animals. I showed the insect has trouble maintaining itself in the woodlands of Massachusetts, where as adult and larva it can climb the trees and be out of reach of many of the enemies that attack it on and in the ground. When I tell them such things, referring to their own writings, they, the Entomologist and the Pathologist, make their Superior say "his recommendations obviously are purely theoretical and made without experience with the insects and without other knowledge of the various subjects he treats than that afforded by the literature."

On pages 21 and 22 of my Circular No. 157 you find some of the main causes why the use of poultry is the best means to control the Argentine ant at large as pointed out as far back as my Circular No. 147. The Entomologist does not want to admit this, or in turn show why it should not be so. On page 14 of his report for 1919 he makes reference to a new ant poison used in connection with banding to protect citrus trees against multiplication of mealy bugs through the agency of the Argentine ant "which has resulted in one of the most notable successes in insect control in the State of California." In the case of citrus trees such a treatment is quite feasible as far as cost is concerned, but ask the Entomologist how he would prevent the Argentine ant from fostering the mealy bug on sugar cane and other crops and he has to admit he has

nothing that is tangible.

On page 31 of my Circular No. 151 I had shown from the Bureau's own writings (Ent. Bull., No. 122, p. 73), that an English sparrow was found industriously picking up the Argentine workers from a trail, as also a flicker digging up shallow ant nests for adults, pupae and larvae, yet according to the Entomologist's contention I was wrong when I claimed that poultry, being by nature an enemy of the pest, can and should be made the chief reliance to control the pest at large.

On page 38 of my Circular No. 155 a short reference is made to poultry as the best means to control the alfalfa weevil, a plan partly endorsed by the Bureau of Entomology in D. A. Bulletin, No. 107, p. 57. If poultry is of value when used sparingly as there admitted, why cannot their number be increased and they thus be used to protect farm crops at large. The Bureau advises the use of poison. While this can be made to give satisfaction as far as it goes, I had shown on pages 8 to 15 of my Circular No. 155 that alfalfa may be attacked at the same time by other pests where poison is of little or no use, while poultry is of use. I mentioned the garden web worm, discussed as an alfalfa pest in Farmers' Bulletin, No. 944. The insect is not at all readily amenable to treatment by poison, on field and forage crops, but I showed poultry can readily secure the pupae in the ground, also many adults as they hide about the plants during the day, and they can secure the larvae on the plants. Then there is the alfalfa caterpillar, the larva of a butterfly. This insect can easily be secured by poultry as adult, as larva on the plants, and as pupa hanging

on the plants. Rootborers might be present, as briefly mentioned on page 13, and carried out in detail on pages 1 to 4 of my Circular No. 145. Poultry is far the most feasible means to check this trouble by securing the bulk of the adults. If not, have the Entomologist show why this should not be so in this and all the cases previously mentioned, and many others specifically discussed in my Circulars No. 146 to 157.

However the habits of the majority of the injurious insects are such, poultry can be but little used in their control or not at all. Of the newer insects of this class the European cornborer makes a good illustration. In the case of this insect the use of poultry is thus summed up on page 11 of my Circular No. 156, which gives on pages 1 to 11 a complete description of my means of control: "During the resting season infested grasses and weeds will break at many of the points infested and poultry given the run will get a large part of the borers." Poultry can thus get the borers down to the roots, really the only feasible way they can be gotten at all there and without having removed the protecting shelter furnished by the tops to the roots of the plants, if perennial, during the winter; or, in the case of annuals, furnished for the protection and enriching of the soil and the sprouting of new growth of better plants than could succeed were such protective cover removed. In cool sections of the country where this insect is singlebrooded, this course goes a long way as a means of control. In such sections corn growing is not much of a factor, but the insect can there seriously injure many other plants, since with its wide range of foodplants it can increase enor-

mously within a few years. My plan to attack the insect during the breeding season, as briefly given on page 3 of my Circular No. 157 in the case where the insect is singlebrooded, consists in providing a patch of grasses, forming seedheads at the time the bulk of the hibernated moths are about to lay their eggs. If the surroundings are kept reasonably clear, by mowing or grazing, of suitable seedheads for the time being, this trappatch will receive the bulk of the eggs. The sooner this trappatch is cut after the bulk of the eggs has been laid, the greater will be the mortality of the larvae developing in this crop. In any case, if this crop is carefully utilized before the time of emergence of the moths the following spring, the bulk of the borers that would otherwise survive will have been killed, doing away, simply by the judicious growing and cutting of forage crops, with the necessity of winter attack as claimed by the Entomologist in his report for 1919, p. 1, as follows: "...The vulnerable point in the insect's life history is in its hibernation as a caterpillar in the stalks of corn and in the stems of other plants which it attacks and there is a large list of them...." It is exactly the large list of food plants what makes winter attack impracticable, all the more as destruction, one way or another, is to include "the stubble and upper part of the root," and the plants attacked include many perennial plants both wild and cultivated, all of which need the "stubble and upper part of the root" as a protection against thawing and freezing to even survive. In practice we know that these foodplants are scattered over lands owned by many different people, many of them not directly interested in con-

trol. A law to permit a neighbor to let poultry run over such uncared for lands during the dormant season can easily be passed, while enforcement of repression after the U. S. Entomologists' method is out of question. The insect is carried in spinach, celery, beans, beets and other truck crops, and certain part of New England dependent upon these supplies from the infested area in Massachusetts opposed quarantine rather than go without the supplies.

".... By the failure of the Federal appropriation the opportunity for very effective work was lost...." A claim the appropriations were short or not available can always be worked by supposedly honest experts on Members of Congress that listen only to their side of the story. If to offset this calamity, the House Committee on Agriculture will now only get a good hold on the Entomologist's wool, we will soon settle down to very effective work all around. "The result was that with the appearance of the moths issuing from untreated or imperfectly treated areas in Massachusetts there was a spread at the end of the fiscal year, so that at the date of the present writing, August, 1919, the insect is known to occur over an area of 1000 square miles...." By October 1st the spread is given as 1200 square miles in the report of the Federal Horticultural Board. The pest is now considered to have been "introduced about 9 years ago (1910) with large importations of Hungarian broomcorn," that is, was not discovered till 7 years after its introduction.

Where the insect has two broods, the first brood is to be taken care of by the use of forage crops furnishing an abund-

ance of suitable seedheads, and cut in time to cause the greatest possible mortality of the grubs as just described. If the trap crop is not cut, because of rain or for other reasons, till the borers are nearly ready to emerge as moths, this trap crop should be at once baled to reduce the emergence of moths to the minimum. However, if corn is to be protected against the second brood, this can be done by providing another trap-patch at the time the moths of the second brood appear. This might be corn sown rather thinly for fodder, with many stalks then throwing up tassels, or we might use a suitable mixture of grasses just then heading.

However the corn or other crop it is desired to protect may be as attractive as any that can be provided. This is especially likely to happen where there are 3 to 5 broods. Some of the broomcorn in which the pest was imported went to New Orleans where the insect could produce 4 broods, with 5 in South Texas. To obviate this difficulty I described on pages 5 to 10 of my Circular No. 156 a system of trapping the moths with some such apparatus as shown on last page, fitted with certain attachments. In practice the torch illustrated is suspended on the hook shown in the illustration as serving as a handle for the piston rod, about 12 feet from the ground, hose, pipe and burner to hang down perpendicularly. A pail is hooked on the burner. This pail receives a spitton-coverlike fitting, flush or slightly below with its top, and over the burner is placed a similar lampshade like fitting. This leaves a circle of light to shine forth from between these two corresponding cone-shaped fittings, one and one-half inches

apart being about best for general work.

The pail contains some sweet smelling liquid. In the case of the corn borer a mixture of molasses and water would probably be the most suitable all around. This mixture, being kept steaming through the blast blowing down upon it, attracts insects fond of such sweets, even if these insects were otherwise repelled by the light. The torch doesn't make a bright light. This in cases where insects are rather adverse to light is an advantage. Also where the place is rather small, since each individual farmer is primarily interested in freeing his own grounds, not those of his neighbor. According to a statement made by the Entomologist before the Committee the corn borer is attracted to light and has been known to be carried on trains because of thus being attracted. If thus a crop it is desired to protect is as attractive to the moths as is the trap patch, such a torch placed into the trap patch would detract, both by the light and by the smell furnished, the moths from the crops it is desired to protect. Even if the trap did not catch a single moth, it would protect the crop indirectly by inducing the moths to oviposit on the trap patch.

Thus in the cotton belt the corn borer would no doubt breed in cotton squares. And what is more, it would be difficult, if not impossible, much of the time to provide a more attractive crop for trapping, as the squares when tender and plentiful are likely to be preferred to all else. What is the use to protect the squares with poison against the bollweevil, feasible only late in the season, when the corn borer can destroy every square in spite of such protection, being not ma-

terially affected by even frequent use of poison?

The same holds good with the pink bollworm, now getting well established at the northern border of Mexico and present now in certain parts of Texas. The limitations in the use of poison in the control of the bollweevil are discussed on pages 1 to 4 of my Circular No. 154. The reasons why with the pink bollworm present in Mexico it cannot be kept out of the United States are given with means of control on pages 12 to 18 of the same Circular. It is there shown that in the first place the pink bollworm causes a severe shedding of squares early in the season. Imagine with the bollweevil, the European cornborer and the pink bollworm all causing severe shedding, with the corn borer capable over most of the cotton belt of producing 4 broods at an average of 450 eggs per female and the pink bollworm a good second, both increasing with virulence towards the end of the season in the absence of any efficient official means of control, being limited in increase purely by lack of suitable oviposition material as far as cotton is concerned. Of official means the Bureau has for the control of the bollweevil only poison, which is effective only late in the season, and not likely to be of much value where the season is short, or if bugs, lice or red spiders are present also, to take what the bollweevil does not take. For the corn borers there is nothing officially endorsed but "cleaning up" in winter, and for the pink bollworm nothing but a similar "clean-up."

Speaking of means of controlling the pink bollworm you read on page 7 of the Report of the Federal Horticultural Board for 1919 that "under the labor scale in the United States

the intensive clean-up methods required" (to control the insect in Mexico and Egypt under the present official methods) "would be almost prohibitive in cost." At that the "methods" are only "fall cleaning and destruction of old plants and the re-planting with clean seed." That is the Bureau has no means to attack the insect during the growing season. I quoted on page 16 of my Circular No. 154 from official literature as follows: "The pink bollworm affects the production of cotton in several ways. First a considerable number of squares and bolls are so injured that they fall to the ground. In case of heavy infestation fifty per cent of the crop may be destroyed in this way...." And I there showed that poultry would secure a certain number of the moths hiding on the plants during the day and "poultry forced to patrol the cottonfield by being fed and watered and held there long and often enough to keep the pest under control will attack these squares and bolls same as they are wanted to attack squares and bolls infested by the bollweevil....it is obvious that the most efficient work with poultry is early in the season. . . ." I also there showed that where there are two or more broods of the pink bollworm a year as occur on American cotton in India and would occur in most of our cotton belt, the pupal stage is spent in a cocoon in the ground an inch below the surface, being thus also subject to attack by poultry. All this, according to the U. S. Humbugologist is purely theoretical. Having stuck his snout out of the rathole and spit out his venom, he crawls back, hoping he won't be followed by a hot poker.

As given briefly on pages 19 and 20 of my Circular No.

157 I had shown that the destruction of cotton stalks early in the fall drives the bollweevil to adapt itself to go either without cotton during this period, or learn to breed on plants other than cotton. I showed that if a small patch, preferably reserved at planting time, and located in the center of the field, about the hundredth part of the field in size, be sown to cotton very late, this patch would attract the bulk of the weevils, where poultry could make constant war on the grubs in fallen squares, and also on the adults up till frost, and even up to the destruction of the plants, that thus there will be but comparatively few weevils to enter hibernation even with all the plants left standing and bearing till frost. I showed that poultry could patrol all the fields in the winter and spring, showed that with the falling of squares poultry could be made to patrol the cotton field. Thus if the corn borer or the pink bollworm, or both, be present, poultry could keep these down at the same time. In addition I showed both the corn borer moth and the pink boll worm moth could be attacked by the use of a torch light trap, as previously described.

For a number of years the Bureau of Entomology had practically nothing to say about the size of loss caused by the bollweevil. On the contrary they made a systematic effort to have the farmers look at the bollweevil as a blessing in disguise through forcing diversification of crops. Now that a partially successful method of using poison has been evolved, Secretary Meredith says the department has found a way to get the weevil, and gives the loss in years gone by as \$200,000,000 a year. But after you have read Farmers' Bulletin

No. 1098: Dusting Machinery for Cotton Boll Weevil Control, you will come to the conclusion that there are yet, as practically there admitted, a good many obstacles in the way of success, and that the use of a trappatch late in the season, as advocated by me, by concentrating the weevils, also makes much easier the control of the weevil by poisoning, if this method is chosen in preference to the use of poultry, by keeping poisoned only this trappatch.

Secretary Meredith says the pink bollworm is present already in 12 counties in Texas and Louisiana, and says we have to eliminate it without delay. The worm was discovered in the fall of 1917 in 3 localities in Texas and the "eliminating" began right there and then. A spread to 12 counties meanwhile, in several localities, and in spite of the Department's best efforts, does not look much like elimination. Moreover I had shown on pages 12 to 18 of my Circular No. 154 that with the worm established in Mexico, the worm cannot be kept out because the adult lives for about 17 days, and in the absence of cotton can feed on pollen or nectar of other malvaceous plants, thus can travel long distances in search of cotton, its "much favored food plant." In addition: ". . . Hibiscus and other plants closely related to cotton may serve as hosts for the pink bollworm . . ." (Rep. Fed. Hort. Board, 1919, p. 7). Thus elimination would not be worth while, even if it could be secured at moderate cost, since reinfestation across the Rio Grande would follow at once. Mr. Meredith admits the worm "may cost another \$200,000,000 a year." Hence the need of having the merits or demerits of my system of control

sifted to the bottom.

"Imagination spells the difference between small success and big success," says Secretary Meredith. Yet it is imagination, or theory, about me what the U. S. Entomologist is always harping about. All investigations are based upon imagination, or theory, and the investigation most needed just now is to have the Entomologist's wool examined, for, in effect, he claims to have examined mine.

As the U. S. Entomologist is trying to throw brickbats at me while he thinks the throwing is good, we might just as well look at some of the tests he intends to make to establish the life history of the European corn borer. In the hearing before the Committee the question was raised how far the corn borer moth can fly and the reply was given as 600 yards as the longest known distance at a single continuous flight, the moths being capable to make many shorter flights in a given evening.

At the same time Dr. Howard said the experts in charge propose to set aside a territory of 25,000 acres heavily infested and try to eradicate the pest from there. As the pest is to be attacked practically during the hibernating period only, with trap crops and trap lights such as described by me condemned, and as the pest goes as low as the "stubble and upper part of the root" of practically any hollowstemmed plant, wild and cultivated, and with the borers admittedly capable of being completely hidden in ears of corn, this in itself can safely be said to be an absolutely futile attempt. But granted those 25,000 acres can be cleared regardless of cost, and it would cost about as much as pumping the ocean dry, I had shown

on page 35 of my Circular No. 155, that 25,000 acres, the area there given as being infested by the Japanese beetle, is about equal to 39 square miles, and that a circle with a radius of three and one-half miles would include this area. Three and one-half miles is about 18,000 feet and as a flight of 600 yards is 1800 feet, we find that a moth is likely to fly all through the patch the first evening, which means that such a test cannot have the slightest value.

Also one member of the Committee showed a clipping from an agricultural magazine giving a report by one of those "show-me" fellows on how he found experts of the Bureau to work at establishing the life history of the borer. He said 4 experts had been detailed to clear a small piece of ground of the cornborer, and as he found they made very slow headway by using snippers, asked them why they did not use a scythe, as then one man could do the job in half a day. He said they told him they were to remove only hollow stemmed plants, and this was the cause of the slow work. Evidently they were under orders to carry out an experiment, probably on a small scale the very thing that Chief Howard now proposes to do with 25,000 acres.

Anyways, Dr. Howard showed no hankering for details, but began at once to whitewash his experts on general principles by saying, that plenty of people call laborers, employed by the Bureau, experts, that it is usually difficult to secure the best kind of help, and that the work is not at all done that way, thus putting the responsibility upon common labor's broad back. As the cost for half a day or a day was given as fully 50

dollars, it must be clear that it was not common labor that was employed.

In calling attention to the benefits to be derived in the control of the bollweevil from the use of poison on cotton late in the season, Chief Howard mentioned a profit of 9000 dollars on 150 acres made by one of the southern State Entomologists saying in effect: "This shows the possibilities of results in using a trained man." A member of the Committee thought this was not a particularly good showing when Dr. Howard said: "Of course we can do much better than that." The facts are, anybody knowing enough to make a farm pay could do as well as that State Entomologist could, after Mr. B. R. Coad had described the method in Department Bulletin, No. 731, and to be able to do much better is virtually nothing but an idle claim. It so happens that the expert in question is the one mentioned in connection with his worthy colleague, the State Horticulturist, on page 7 of my Circular No. 154, the latter making Mrs. Hettie Dawson, their colored cook, say chickens won't eat bollweevil, and who both refused to make that statement over their signature. This same expert was doing the leading work under Dr. Hunter in getting out the life history of the bollweevil as given in Entomology Bulletins No. 45 and 51.

As the Bureau now recommends the use of poison late in the season, this means plants bearing squares available for breeding up till frost, and a consequent heavy survival of weevils in the spring, and brings again the question to the front as to what can be done to reduce their number in the

spring. The Bureau after testing the benefit to be derived from the picking up of fallen squares for 20 years had to admit that it is not feasible even with stalks destroyed early in the fall.

Contrary to the Bureau's claims I showed from their own tests that the bollweevils as they arrive at a field, that had been previously cleared of them, if present, by a plowing well ahead of planting time, settle at the edge, and from this I proved that the only possible chance then known to check the weevil in the spring through collection by hand labor consisted in examining the edge of the field daily for arriving weevils after squares have begun to form and keep this up till emergence is over, thus preventing females settling at the edge from becoming fit for oviposition by feeding for 4 days upon squares and fly into the field in search of more squares, 5 squares per day being required by a female then on the average.

I proved this from a test recorded in Entomology Bulletin No. 45, p. 87, also given on page 115 of Bulletin No. 51. The field in question was in an isolated location and planted new to cotton, and when infestation was discovered on August 6 it was "entirely restricted to a small area," the claim being made "it is evident that infestation began some time in July." As early as my Circular No. 32, February 18, 1905, I claimed from this that infestation is originally confined to the edge of the field, but, as the Bureau did not take any action on this point for 5 years, it was not till my Circular No. 117, 1910 that I pointed out that unless the weevils are promptly picked off before any females are fit to oviposit, they will work their way

into the field. I carried this out in minute detail for the first time in my Circular No. 127, 1912. I showed that Dr. Hunter, in charge, and his staff were wrong in claiming that infestation began in July, because they had to admit that infestation came from a cottonseed house just across the corner where infestation began, from which it was clear that infestation began during the usual time of emergence, say March 1 to June 1 in that locality, Victoria, Texas. Hence the weevils had practically 3 months in which to feed on squares and were by August 6 still confined to a small area, only explainable by assuming that the original infestation was extremely slight in this case. This in turn showed that usually the infestation is much heavier and that therefore if the weevils are to be secured by hand labor they must be secured daily at the edge during the period between the beginning of the setting of the squares and the end of emergence, usually about four weeks. To get a female there means to prevent the oviposition of an average of 139 eggs in that many squares, all scattered over the field. Not only this, but it means to let weevils fly in unchecked before any picking can begin, a period of about 10 days to the first fallen square. Moreover many squares shed without being infested. From all this it was possible to show in a mathematical way that the picking up of squares is of necessity utterly unprofitable. The Bureau now admits this.

When beginning to realize in 1915 the possibilities of using poultry in the control of the bollweevil and many other cotton insects, many of these feeding and developing a first brood on the early vegetation outside of the cottonfield, I first

of all called attention to the benefit that could be derived through watching the surroundings and the edges of the field with poultry in the spring, originally given on page 20 of my Circular No. 147. Subsequently I showed that poultry can be used the year around and made especially efficient by the use of a trappatch in late summer. This course renders the poisoning of cotton for the bollweevil quite superfluous and takes care of bugs, cutworms and many other insects not amenable to poison.

If poultry were not thus efficient as claimed, the trappatch could be kept heavily poisoned from July till cool weather sets in, doing away with the difficulty of poisoning the whole field.

The forced reliance on the late use of poison under the Bureau's present system of control exposes the crop to many other dangers. Aside from insects and fungi there is the added danger of a wet fall.

Mr. Hutchinson, a member of the Committee, incidentally wanted to know how to control the wheat moth, saying the insect is becoming a great pest in New Jersey and a large part of Pennsylvania and threatens to spread all over the country. Dr. Howard said, the insect was long known to be present and never attracted much attention, and the matter is in the competent hands of Dr. Headlee, the New Jersey State Entomologist, and that the chief thing to do is to trash a little earlier so that fumigation of the trashed wheat may take place that much sooner. Mr. Hutchinson said, it is impossible for every-

body to trash earlier, which, of course, is true, since the thrashing outfits would be inadequate in number, and busy only a very short time each year. •

As near as can be seen the only means of control the Bureau has to offer is fumigation after the grain is thrashed. The adult infests the ripening grain in the field, also the grain in the shock, and when stacked in the barn. As long as the grain is not thrashed the pest breeds thus unchecked. When I then come and point out a new means of control as I did on pages 17 to 20 of my Circular No. 155 and pages 6 to 10 of my Circular No. 156 in describing a new system of trapping adult insects, the Entomologist talks about dishing up a theory in one breath and about having tested out the theory repeatedly and found it wanting in the next breath.

To make the point in question plain I will show how it works out in the control of the codling moth and the Oriental peach moth, a matter discussed on pages 15 to 20 of my Circular No. 155. I showed there that for the last named new pest, apparently capable of doing very much greater harm than the codling moth because of its wider food range, the Bureau has not only no practical means of control at all now, but has nothing whatever in sight. As for the codling moth you read in the report of the Entomologist for 1919 on page 5: "In the Grand Valley of Colorado codling moth losses have always been severe and many orchards have been unable to obtain satisfactory control even by thorough spraying." (By 'thorough spraying,' according to the Entomologist's report for 1918, is meant a schedule of six applications of arsenate of

lead at the rate of 4 pounds of the powdered product to 200 gallons of water with the addition of 4 pounds of fish-oil soap). "Study indicates that this was due to lack of co-operation among orchardists thoroughly to spray over a large area. Consequently arrangements were made with a number of contiguous orchardists whereby they individually agreed to spray according to the Department's recommendations and thus try out on a large scale the effect of uniformity of spraying operations over hundreds of acres. This prevents the overflow of codling moths from poorly cared for orchards into well treated orchards and good results are expected."

The Entomologist thus admits that the codling moth does a good deal of flying. After a while he may specifically want to have every pome fruit tree growing wild in the woods cut down, although in a general way he has advocated that for years, as in fact of every wild form of every plant, grasses to trees, since, of course, all serve to sustain insect pests that attack cultivated varieties. At that rate all "waste places" would have to be kept bare, while nature takes pains to cover all bare places with a mixture of vegetation.

It is well known, in fact admitted and proved by the Bureau, that the codling moth shows a strong preference for certain specially attractive varieties of pome fruits. Thus the second brood of the codling moth will heavily oviposit on sweet summer- and early fall-apples and but sparingly on less attractive varieties near by.

On page 18 of my Circular No. 155 I had recorded a case where a number of sweet-bough apples lying under a tree in

August had in the twi-light attracted thousands of codling moths. The Entomologist, being chuckful of the humbug bacillus, does not hesitate to pretend to be unable to see any possibility of taking advantage of this concentration of the moths. In the first place on pages 8 to 11 of my Circular No. 139, issued in 1913, I asked the Entomologist to satisfy himself that the codling moth is attracted to light such as the torch furnishes. He had now 7 years time to do this, but has done nothing, yet claims this feature with all others has been investigated from time to time and found wanting. If so why does he not give, even in a single case, the results, good, bad or indifferent?

"In the Ozark region of Arkansas....there are 3 full broods....and a partial fourth." Where thus the generations are overlapping, if spraying with arsenicals is to be relied on it is plain that success along the lines laid down by the Bureau, means a coating of poison all through the season. At that, admittedly, "Many orchards have been unable to obtain satisfactory control." It follows, that if poisoning is to be relied on as a means of control, the total work can be lessened if specially attractive trees are kept especially heavily poisoned.

I had pointed out on page 19 of my Circular No. 155, that, with a torch made to operate as previously described in this present circular, the smell given off by the blast blowing down upon some such a mixture as water, crushed, sweet, fermenting apples and sugar would, with the torch located near one or more trees acting as attractants because of the early fruit they produce and with the windfalls kept eaten up by hogs or

otherwise removed, result in trapping vast numbers of codling moths and this would then keep clear a large territory, including codling moths from host plants growing wild, doing away with all the expensive spraying otherwise necessary to secure a certain degree of protection. To use a torch properly means to use it during the early part of dark, warm nights whenever tests show the adults to be present in paying numbers.

Another method of controlling the codling moth and applicable to many other insects and which has never before been published is this: A number of sweet summer apple trees are planted to attract moths of the second brood through their ripening or fallen fruit. This fallen fruit, or anyway, the best of it, is gathered up and thrown into a chicken-proof enclosure. The rest is eaten by hogs or otherwise destroyed. The moths will frequent these apples and a number of chickens caged in the enclosure can secure the moths in the evening before it gets too dark. Or, these apples might be kept covered with some sort of matting during the day, and uncovered and chickens put in only in the evening and nights. A little grain scattered among the apples at twilight will get poultry to work when most wanted.

This course it was shown on pages 9 to 13 of my Circular No. 153 is also the best means of controlling the apple maggot, present over a large part of the range of the codling moth. The apple maggot is not at all affected by poison sprays. As for the Oriental peach moth as this insect feeds upon most varieties of fruit trees, wild and cultivated, the methods outlined are of the more value in this case as this insect is affected by

poison practically only when attacking fruit and then only with great difficulty and expense. The two first broods, out of a possible 4 broods in Maryland, where the insect first attracted attention, breed in growing twigs, stunting them and cannot be effectively poisoned and are but little affected by other expensive official means recommended that seem to act chiefly as repellents and are discussed on pages 15 to 17 of my Circular No. 155. To catch the early broods with a torch trap in the absence of sweet apples, applejuice, or apple jelly and sugar, allowed to ferment, will be about the thing to use in the pail in these prohibition days, sweetened hard cider probably being the best. This then will equally affect the codling moth and other insects of similar habits, as for instance the bud moth, also very difficult to fight by spraying, the only official means advocated.

Still another way to kill the codling moth, the Oriental moth and various pests of similar habits would consist in exposing in a cage accessible to them mashed sweet apples or sweetened apple juice allowed to ferment that have been treated with some suitable poison. In this case, of course the possible effect on beneficial insects has to be watched also. To come back to the control of the wheat moth in the adult form, the family of insects to which this moth belongs feeds but little or not at all as adults and is also but little attracted to lights. Assuming that the wheat moth doesn't sip water and nectar to be found on plants, it may yet succumb in paying numbers to a trap torch giving forth an inviting smell by fermenting sweet fluid, which means the presence of alcohol.

After the sheaves have been stacked in the barn, it would be feasible to thus operate a torch there. It could be lighted outside and then hung or hoisted up to a safe place in the barn. Barns cannot be fumigated. Nor can moths be kept away. Hence the most promising method for control in barns previous to thrashing would seem to be using a trap torch for a couple of hours once a week or so. All that is necessary is to put enough gasoline in to run the length of time desired and hang the apparatus up in a place made safe, when it will run its time without attention.

In mills this course will keep infestation down, doing away with fumigation entirely or partly. If the moth sips liquids, in mills another, easier way is feasible. A solitary electric light of low candle power left burning of nights with some poisoned sweet scented fluid nearby could be made to exert a daily reduction of the various adult flying insects that pass through the mill.

Mr. Ruby, of Missouri, wanted to be shown what insect it was that affected the quality and quantity of the gooseberry pies in his district the past summer. It was found that the imported currant worm was responsible. Dr. Howard said in substance, the first brood is to be destroyed by the use of an arsenical, while, if the pest is present when the fruit is ripening, it is killed by the use of hellebore. Now this, in itself, is well enough. If we had to deal only with insects on the more valuable plants and such as are amenable to treatment by poison, there would not be much need for improved means of

insect control.

Taking the currant worm for an example one or more sprayings or dustings with an arsenical while the first brood worms are small, and this carried out over a neighborhood and not confined to a single garden, will practically put an end to the worms for that year in that locality, and there will be no need to use **the much more expensive hellebore**. In practice we find, however, that usually the worms are left to grow and multiply unnoticed till serious damage results when they are much more difficult to kill with poison and devour the balance of the leaves, if disposed off by making them take the poison cure, with a possible numerous second brood calling for the use of hellebore, with a few leaves to apply it to, making the treatment expensive and unsatisfactory. If the worms of the first brood have thus been allowed to become large before noticed, it is much better to apply a hot air blast with a torch constructed along the lines of the apparatus shown on last page. Such a blast kept swaying over the bushes makes the worms drop, to be killed on the ground. Such a blast incidentally licks off what spores of fungi are present, also affects any San Jose scales or other sucking insects that are present and not amenable to the use of poison, and early in the season is the best and cheapest means by far to keep down the currant aphids and when used then will get most of the first brood currant worms then hatching.

Take another case: An apple orchard is affected by canker worms or other worms devouring the leaves as fast as they appear, or by the adults of the pear thrips, not amenable to

poison, but calling for a special nicotine-sulphate spray applied at high pressure under the Bureau's plan, causing many to become knocked off before they are seriously injured. The cankerworms are usually too numerous or too far developed to be much affected by poison, since there is usually but little foliage left to carry any poison. As far back as my Circular No. 147, 1915 I showed that there is no mechanical difficulty to rig up a torch along the lines of the tower spraying outfits or to rearrange this same outfit to act on insects or fungi at or near the ground, such as on grain and forage crops. Two men on the tower each handle a torch and make the worms drop, while two on the ground lick the fallen worms over at close range to die afterwards. In doing this they also lick over the fallen leaves on the ground, destroying the spores that would otherwise cause scab on the leaves and fruit. The licking of the tree more or less completely destroys lice, bugs and scales if present. There is no need to apply enough heat at any one time to cause any injury, since such licking is to be done from time to time to lick off other insects as for instance the larvae of the highly injurious pear thrips and the spores of fungi on fruit, foliage and bark.

The fungus diseases are worst during the warm, moist weather. Sprays not only are liable to get washed off, but the fungus diseases spread in muggy weather enormously fast and spraying is too slow for best results, while licking with a torch the fruit, foliage and bark, especially licking into the cracks caused by cankers, and licking over the ground below, especially the fallen fruit, is vastly quicker, surer and cheaper

than the present method.

On page 6 of his report for 1919 the Entomologist says the official means to control the grape mealy bug, doing damage of late years in California, consists in fumigating with cyanide of soda and with sulphur fumes during the dormant season at night. Obviously this method is slow and expensive. On page 37 of my Circular No. 155 I had pointed out that the use of a torch during the growing season not only keeps this pest easily down, but at the same time keeps down the grapeleaf hopper and fungus diseases. "With the exception of the phylloxera, the vine hopper is undoubtedly the most destructive insect pest in California," (Cal. Exp. Sta. Bull. No. 198, p. 178). These hoppers easily succumb to repeated slight swift lickings with a blast, especially while in the nymphal stage. Early in the season during cool periods, the adults hide largely under shreds of bark, places preferred by the mealy bug. Woody canes stand a pretty sharp licking, making easily possible the destruction of the mealy bug by the use of a torch.

Two closely related mealy bugs infest the citrus fruits of California. They are discussed in Farness' Bulletin No. 862. Most of the sections of California where mealy bugs are a factor are overrun by the Argentine ant. These and other ants harbor and distribute mealy bugs and defend them against their natural enemies, causing thus, it is officially estimated, an increase five times over what their number otherwise would be.

On orange trees it is possible, so the Entomologist states

on page 14 of his 1919 report, to profitably keep the ants off the trees by banding and by the use of ant poison. This banding is apparently essentially the method described on page 13 of Farmers' Bulletin No. 862 and consists in applying a 5 inch band of paraffin to the tree trunk and over this a mixture of sulphur and sticky tree-banding material "almost one-fourth inch thick." Whether such bands used year after year do not interfere with the health of the tree remains to be seen. Thus far: "...direct application of the commercial sticky tree-banding material alone has never been noted in California to affect citrus trees seriously" (p. 13).

Such use of banding and poison is merely a preventive against the attack by ants on the tree. It does not prevent the ants from breeding under possible trash on the ground, and especially not on rank vegetation around the citrus groves. Orange trees are affected by numerous sucking insects and also some biting ones. The sucking ones—scales, rustmites, red spiders, thrips, mealy bugs—are all amenable to the use of a torch blast. It can readily be used at night. Unless the torch is used, you have, according to official advice, to spray or fumigate for the mealy bug, the same as for scales during the cool part of the year, or, during summer, when sprays are admittedly not safe (F. B. No. 862, p. 10), you have to use a high pressure water spray. For mites and red spiders you are told to use finely powdered sulphur, for thrips to spray with tobacco extract dilution or other suitable sprays. These sprays and powders do not appreciably affect the Argentine ant nor do they affect catydidids, also often present in large numbers. A

blast from a suitable torch affects all these insects and without injuring the trees, if used with as much judgment as is required in using other means of control.

For the control of catyids the Bureau recommends 2 sprayings with arsenicals, estimating cost per acre at \$5.00 (D. A. Bull. No. 256, p. 24). This is admitted to be of value only while the catyids are in the first three nymphal stages. There is no reason why two lickings with a torch would not answer as well. In that case these lickings affect all the sucking insects and the ants present, while the arsenical spray does not affect them.

But oranges, in Southern California at least, are subject also to attack by the orange tortrix, an insect having habits similar to the codling moth. It is discussed in California Experiment Station Bulletin No. 214, p. 494, issued in 1911. This insect, like the catyids, originally fed upon plants other than the orange, hence as orange culture increases, may be looked for to increase in virulence. "During the season of 1909-10 it was the cause of considerable concern in certain sections of the southern California citrus belt." Its food habits render it even less susceptible to the use of an arsenical spray as a means of control than is the codling moth. There are three broods a year. Poultry would probably be of value in destroying fallen infested fruit. With the ground otherwise kept bare there is but little for poultry to feed on except Argentine ants, and, as a rule, some grasshoppers. It would be feasible to maintain a flock of poultry in the grove, changing the location daily, protecting them if necessary against ants at night

by furnishing roosts made ant proof. The only other additional means promising control of the orange tortrix is the use of a sweetish smell produced by the use of a torch as a trap at night, as described for the codling moth.

It is all very well for the Department of Agriculture to go after the man that puts cedar sawdust in the pepper he sells, but what about the U. S. Entomologist that put deliberately hum in his bugology?

The discovery of two new serious wheat diseases during 1919 in Madison County, Illinois, discussed in Farmers' Bulletin No. 1063, brings up with renewed force the question of controlling fungus diseases on grain and forage crops. The new fungi in question are the "Take All," according to the Bureau of Plant Industry a sac fungus, and present also in Indiana, and the "flag-smut," "one of the true smuts" (p. 2).

Disinfection of the seed is usually, if not always, of no use in the control of a sac fungus. And in any case such disinfection would be only a partial remedy, since spores capable of causing infection are present on the land. To illustrate: Corn smut is caused by a sac fungus. The spores that start the disease on corn live over winter on diseased dead corn-stalks, infected manure, other combustible matter and in the soil. They there sprout and produce a crop of spring spores which are blown by the wind onto corn plants to start the disease again. No official means of control at all satisfactory is known.

The use of a torchblast offers, as far as can be seen, the

only workable means of attacking the fungus during the growing season. In explanation, bearing in mind that the flame from a torch is capable of licking off fungus spores, it will be well to first look at the known possibilities in the use of a torch towards the control of the chinchbug on corn. As far back as 1898 I described a satisfactory method of using a torch on corn for chinchbugs, laying stress on the fact that the bugs largely hide under clods at the base of the plant during the night, mornings and cool days, and that licking these clods then does away with all injury to the corn. Besides if a few outer rows were thus necessarily injured or destroyed in combating migration of bugs from nearby small grain, these few rows could be seeded to stockpeas or some other suitable crop and this method of control would still remain far the cheapest.

Soon after 1898 I heard of a case, when a farmhand, I believe in Sangamon County, Illinois, rigged up a 2-horse corn cultivator with 2 torches or more to blow heat onto the plants as a means of destroying chinchbugs while the cultivator went around. It would have been possible to use 8 torches, one in front and one in the rear of each hoe. Now if some such arrangement of torches to sweep all of the ground in front of the shovels were provided, it would be possible to lick the spores of cornsmut off before the shovels disturb the soil. This, especially if repeated at each cultivation, would practically break the circuit of the fungus and control the disease and do this at very little cost.

The infection of wheat in the case of the take-all fungus may and may not be along these same lines. The fact is, the

nature of the take-all disease is as yet obscure. Two diseases similar to the take-all fungus are thus described in Circular No. 228 of the Illinois Agricultural Experiment Station: "The spores of the loose smuts of wheat and barley ripen at the time the healthy plants are in bloom. These spores are blown about by the wind and many of them find their way into the flowers of the healthy plants. Here these spores give rise to smut infection within the very young kernels, which mature without any outward evidence of the presence of the disease. When such kernels are sown, the plants which come from them will produce smutted heads. Because the infection is internal, a method of seed treatment must be used which will have a deeper influence than formaldehyde. Experiment have shown that the smut fungus is more easily killed by heat than are the germs of the grain, and this fact has led to the use of the hot-water method of treatment.... If the temperature rises above 131 F., the vitality of the grain will be seriously injured, if it falls below 124 degrees Fahrenheit it will be ineffective. . . . This treatment is often injurious to the vitality of the grain.... Because of the tediousness of this process, it is commonly used to obtain smut-free seed for a small plat from which sound healthy seed may be taken for general seeding the following year."

Of course this seed plat is subject to infection from other fields, since the spores can be carried for miles. Again other fungus diseases may also be present. Suppose stinking smut is also present. The seed can be cleared of spores clinging to it by the formaldehyde treatment officially recommended. On

pages 28 to 35 of my Circular No. 155 this matter of fungus control by the use of a blast is discussed and on page 35 is given a way of clearing seed by the use of a torchblast: "... by letting the seed slide slowly down over a wire screen and letting one torch, or, better, two or more torches from different directions, play upon the seed, thus licking it clean..." But cleaning the seed does not prevent other spores present in old straw, manure, in the soil or blown in by the wind from other fields from affecting the plants. Suppose a suitable automobile truck with rather high wheels were fitted with a row of burners to sweep the ground while the spring crop of spores is getting ready to be blown up to the plant, this course then would work on all of the fungi. This could be repeated as necessary at intervals as long as the grain plants rolled down by the wheels have sufficient flexibility to rise up enough to permit of the gathering of the heads. This then will lick off the spores from the plants and on the ground and will result in a correspondingly reduced infection for the year following. As now proposed: "... On farms which are infected (by the take-all fungus) a system of crop rotation should be used which keeps wheat, oats, barley and rye off the land for four or five years" This is too long for practical results, besides spores would be blown in from adjoining fields, and, further, the black stem rust fungus attacking wheat can survive on many wild grasses. Hence a direct means of attack during the growing season, such as is found in a blast blowing onto the growing plants and to the soil offers the best chance of success.

There is a great variance of opinion as to what the life

circuit of the take-all fungus really is. Thus in a Bulletin, issued in October 1919 by the Division of the Natural History Survey of the Department of Registration and Education of the State of Illinois, Stephen A. Forbes, Chief, and written by Prof. F. L. Stevens, the opinion is given on page 263 that "we have here several distinct diseases due to as many separate causes."

However one thing can be considered as manifest: that the disease that does the actual damage must be caused by a parasitic fungus. On the other hand it seems that the same fungus can subsist and produce spores forming the successive stages of the circuit on the dying and dead plant, being thus in its later stages saprophytic.

With these spores produced on the dying or dead plant at the time the wheat plant is in bloom, the disease could be spread by them, infecting the incipient seed—and this probably is what happens in this particular case—or it is also possible the spores may cling to decaying vegetation, the soil, and to the as yet growing and ripening plants, and later to the seed, to infect the young plant as it develops from the healthy seed. In any case spores must be produced for reproduction and this chiefly happens during the period while wheat is in bloom. Therefore, then, in any case, licking the plants over with a torch at suitable intervals is the most feasible means now known to destroy the spores.

While the Bureau of Plant Industry has been wanted for 22 years to satisfy itself whether or not a blast from a torch does destroy the spores of fungi, and has done nothing, it so

happens that Dr. S. A. Forbes had investigated to a certain extent the claims made by me as far back as 1898 on this point, and had published the results of a test along this line as far back as 1903, a matter referred to on pages 31 and 32 of my Circular No. 155.

As to insects Dr. Forbes did not give the matter a decent test, since this use of a blast was intended chiefly for sucking insects such as lice, scales, grapeleaf hoppers, or insects hidden about or under the plants as chinchbugs, harlequin bugs and vine crop pests and for such leaf eating insects that are not readily killed by poison and especially if they are gregarious, as are fleabeetles and blisterbeetles, or for caterpillars that had eaten up nearly all of the foliage. Dr. Forbes practically ignored all these and claimed he could not readily kill a woolly-bear caterpillar with a blast. Neither could he have killed it at all readily with poison. These caterpillars are general feeders, pupate under rubbish and had best be combated with poultry scratching for their cocoons, usually located in ground covered by a heavy stand of grass.

Nor does this point matter just now. This was a matter for Chief Howard and his staff to test out thoroughly. As far as they were concerned, they took a cabbage thickly infested with lice and attempted to rid it by one application of the blast, using too much of course, then reporting the method to be useless. No spray could rid such a plant even with several applications freely made, while the proper use of the torch consists in frequent slight lickings, never giving the lice a chance to become plentiful. This is immensely better and

cheaper than the use of a spray, recommended by the Bureau to be used at the start and at intervals.

Thus in the case of the melon aphid for instance the blast is blown slantways upon the ground when the deflection reaches the underside of the leaves, whereas the Bureau, as explained in detail on pages 2 to 7 of my Circular No. 153, shows on page 1 of Farmers' Bulletin No. 914 one man lifting a vine and another using a compressed air sprayer to do the spraying, very slow and expensive. Besides vine crops do not want to be handled.

However Dr. Forbes tested the blast also on at least one kind of fungus. He found he could lick off the spores from a mildewed lilac leaf and, while admitting this was satisfactorily accomplished, said that after some days another crop of spores was found to have appeared. Of course this second crop was produced by the mycelium working inside of the leaf, same as the first, and the fact that it was produced at all shows that the leaf had not been injured when the first coat of spores was licked off. Thus the whole question resolves itself to whether it will be possible to apply a blast under the varied conditions to be encountered at low enough cost. There is no difficulty in constructing a torch for any purpose, similarly as the various spraying machines of today were evolved from the bucket spray pump. As for cheapness, a blast generated by gasoline is far the cheapest combined contact insecticide and fungicide and the only means that can at present be considered to destroy fungus spores on grain and forage crops. Of course there is need for a method of utilizing a lower grade

of fuel for this same purpose.

At the present rate of use the supply of mineral oils will be exhausted in a comparatively short time. Consequently any suggestion of an increased use should be met by an attempt to devise some means to make use of a killing agent for insects and fungi that is likely to be available for many or all generations to come.

It should prove feasible to use electricity. While water power may increase sharply in cost, we are not likely to run short of winpower. This should give us reasonably cheap electricity till doomsday.

Inasmuch as insects and fungi have to be combated chiefly during the warm part of the year, the ideal way would seem to be to make use of the rays of the sun, by concentrating them by the use of a suitable mirror right on the job, and thus finding a way to create a flame and heat and apply same to the vegetation as you go.

“Not all is graft and politics down in Washington,” says Secretary of Agriculture Meredith in referring to a reduction in appropriations for his Department. Evidently he does not look for much else outside of the Executive Departments. “I am going to work as advertising manager of the Department and if I can give the people some idea of the honest work done and the benefits derived from them I will do it.” On the the other hand he deploras “the tendency to discuss waste, graft and soft snaps,” as regards the Executive Departments.

“Washington,” in this case, evidently means Congress.

But it can be shown that on the whole, there is neither more nor less graft in Congress than the Majority, that sends the Members, wants them to have, and that, if Secretary Meredith really wants to do the country one sure enough good turn and set a good example, at existing appropriations, he simply has to bring the issues discussed in this Circular up for honest work by the respective Members of his official Family.

For example: The majority of the Voters instructed the Members of Congress to pass the prohibition law we now have, and Congress did its best in having it passed. On the other hand some little movement was attempted in the past to prohibit divorce, and Congress did not pass a law prohibiting it, simply because there was not even a slight prospect that a majority of the Voters wants it prohibited. That shows that Congress does give the People what the majority of the Voters want, and if the thing thus given proves to be no good, Congress puts the blame on the people where it justly belongs. As long as most Congressmen are expected to get the largest possible appropriations for their respective territories, so long we shall hear about misappropriations.

We have now had prohibition long enough to see how it is working out. The rich antis go in swarms across the border to Mexico, Cuba and Canada to tank up and gamble, spending about 2 billion dollars a year. The middle class and the poor manage things at home. You cannot keep tap on them singly, not by spending a billion dollars a year in enforcing the law. Personally I am a total abstainer since many years but I believe that humanity is best served by permitting a strictly

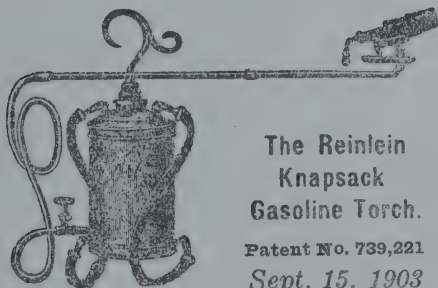
temperate use of alcoholic beverages. Of course, they, as all else good in itself, can be misused. As long as we cannot get a majority of people to voluntarily live temperate lives and to enforce a law to that effect, it will be useless to try to make things better by an attempt to enforce an absurdly strict prohibition law. It is not much of a raisin pie that does not exceed the limit of one-half per cent of alcohol. It is better to fry the fat right at home out of those that make hogs of themselves through drink, than to have them carry the money across the border.

We often hear it said that this country of ours is a Christian one. If so, Christ sanctioned the temperate use of alcoholic beverages by His example. On the other hand, look at divorce. Christ absolutely forbids it. Where then does the Christianity of the majority come in?

It is unlawful to say the Lord's prayer in our public institutions of learning. Consequently they are un-Christian and anti-Christian. It is not lawful to instruct the child towards a belief in God in these schools. Consequently they are in the last analysis atheistic. That this is so is proven by the fact that atheists are loud in the condemnation of those that maintain private schools where religion is taught. The child is taught in the public schools to imitate Washington, Franklin and other great Americans, but sight is lost of the fact that these men were not the product of atheistic schools. They took Christ for their pattern and made a more or less successful effort to imitate Him. The child in our public schools hears nothing of the humility, purity, obedience and voluntary pov-

erty as shown in Christ's life and in that of His followers. It is no wonder then that crime increases in leaps and bounds, especially among the young, and statistics show that children of divorced people make far the worst showing. If we do not like this, we have to see that some better seed is planted. The trouble is with ourselves. Absence of belief in God results in an inordinate love of created things by both rich and poor, and the worship of the golden calf.

Since we all are liable to fall, it is only fair, relative to the issues under discussion, that Secretary Meredith make good his claim of giving honest service by having his experts do what they were all along wanted to do—to either admit that I am right, or show wherein I am wrong.



**The Reinlein
Knapsack
Gasoline Torch.**

**Patent No. 739,221
Sept. 15, 1903**

R 27c Ag Sims

An Abuse in Federalization

Copyright, 1922, by Fred Reinlein, 144 West Kilpatrick Street,
Portland, Oregon

Circular No. 169

MAR 10 1923
March 16, 1922

U. S. Entomologist Howard in his report for 1921 makes the claim that no satisfactory means of controlling numerous important insects are known, when it can be shown that such means were shown to him long ago.

To illustrate, take the grape mealy bug he refers to on page 9. This insect is a softbodied scale, has 3 broods in the locality of Fresno, Cal., and the various means of control recommended by the Bureau in the past have proven to be useless, and the use of miscible oils, now being tested, will undoubtedly also prove to be so. As soon as Chief Howard first called attention to this pest in his report for 1918, I pointed out on page 37 of my Circular No. 155, issued in 1919, that the flame and heat from a suitable blowtorch makes an ideal means of control, just as a blast from a suitable torch would make an ideal means of control for the more widely known woolly aphids of the apple. For work on tall trees a torch outfit can be constructed that, to insure even flow, forces the gasoline up a pipe about as high as are the trees, the pipe there to be fitted with a valve to prevent backflow. As a matter of fact I had shown as far back as 1898 that such a blast kills effectively San Jose scale and coccids and aphids generally. This use of a torch is extremely inexpensive. By going over the plants rather swiftly and often, sucking insects on grapes like mealy bug, aphids, grapeleaf hopper, scale and the webbed clusters of the grapeplume moth are all kept down with minimum cost, and, moreover, I showed, as far back as 1899, that at the same time are then being licked off the spores of fungi.

The Office of Plant Pathology for 24 years was wanted to show why they did not want to endorse this claim.

Taking a look at grape insects generally, we find that for several, the grapevine root borer, the grapeblossom midge and various flygall makers, virtually no means of control are known, and that the use of poisoned sweets, as originally described in my Circular No. 164, for the control of the Mexican bean beetle, holds out far the most promising prospect for control, both for these, as also many others now controlled by much more expensive means. Soon after the Mexican bean beetle had begun to attract attention and had taken to feeding on cowpeas, a knowledge of the feeding habits of this insect, its aversion to poisoned foliage and the flight of the adults to unsprayed beans, and the impracticability of keeping new growth on quickly growing bean plants coated with poison, made it clear to me that to use poison in the usual way, as the Bureau is even now aiming to find a way, cannot be a success. In my Circular No. 164, I showed a way of poisoning the adults by exposing sweetened poison made sufficiently attractive by the addition of sweets to induce feeding on the poisoned foliage in preference to the unpoisoned. The poison was to be applied to the beans by using a wagon carrying a tank, say a barrel, whence sweetened poisoned liquid flowed to a pipe in the rear extending across several rows, the liquid dripping upon burlap aprons hanging from this pipe and lightly dragging over the plants, thus smearing the liquid on and avoiding all the waste incident to spraying. Under this method it is feasible to coat only enough of the topmost leaves to provide enough attractant for the beetles, rendering thus the use of well sweetened, highly attractive poison practical. I also showed that since the beetle concentrates largely upon preferred varieties, or fields in especially attractive condition, it means economy to poison these first. I showed,

further that most coccinellids, to which family this beetle belongs, under proper conditions, come readily to light, that, therefore, the placing of a light, for instance a lantern, during the forepart of warm, still, dark nights in an attractively and heavily poisoned patch of such preferred food would concentrate the beetles from a distance. In addition I showed two entirely distinct other methods. One is the use of a set of gasoline torches to lick off the larvae and kill them on the ground. The other is the use of a torch used as a light trap at night, described on pages 15 and 16 of my Circular No. 160, in connection with numerous other new means, on which, as also on other methods subsequently published, Chief Howard has refused to act.

Who is to blame? First, Chief Howard, the scoundrel, for deliberately and persistently fighting all progress, solely because the methods I describe are not original with his Bureau. Second, the Secretaries of Agriculture, past and present, for refusing to call a show-down in response to requests for such on the part of members of Congress. Third, Chairman Haugen, of the House Committee on Agriculture, and other members of Congress specially posted in these matters, for failing to insist on an explanation. Fourth, Governors of states specially affected, for not asking their delegation to Congress to insist on a show-down. High taxes? Serves you right. Who makes them but yourself?

If such things can happen when the line of action is well defined by law, what can you expect if, as is now proposed, we federalize education and welfare work, when what the terms education and welfare are to mean is not clear and no attempt is made to make it clear. If education is to mean mere training in secular matters, and if, as is now the case in the public schools, the teaching of religion and of morals is to be ignored, with man naturally more

inclined to evil than to good, we would under this system pay more heavily than we do now for a system that tends to grind out bad-check artists, hold-up artists, bare—nearly-all female stage artists, and so on. As the case stands now, with religion officially ignored in the public schools, how can the State consistently expect an oath of office or an oath before a judge to mean anything to anyone educated under that system?

As for welfare work, if by that it is not intended to mean to make provision for a lot of useless would-be federal papsuckers, but, if by welfare work is meant the development of a true spirit of charity among men, I reply that such charity can only spring from, and is the normal outcome of, an education that is based upon religion, and that this charity should be carried out first of all and most extensively right at home, where we know the exact conditions in each case and can make a dollar go several times as far as a cornfed papsucker could from Washington.

In my Circular No. 162, which is now out of print, I discussed certain present-day problems, and there incidentally showed, that, with conditions as they are, what the public school pupil, high and low, is lacking in his course of instruction is the teaching of a general knowledge as to what the different religious and irreligious beliefs the pupil meets in actual life, are based on. I showed that representatives of the different beliefs and disbeliefs should write short pithy essays, adapted to the various grades, setting forth the essential reasons for their beliefs, leaving thus the pupil by the time he graduates to come to a conclusion all his own in accordance with the promptings of his conscience, no matter what beliefs or disbeliefs the various teachers may follow. I also pointed out that this course provides the very best means of acquiring efficiency in sound logic.

Mexican Bean Beetle Control

Fred Reinlein, 144 West Kilpatrick Street, Portland, Oregon

Circular No. 171-A

January 5, 1924

So little in the way of controlling the Mexican bean beetle has been officially accomplished, as admitted in the U. S. Entomologist's latest reports, it should not be hard to induce anyone afflicted with this pest to carefully weigh all logically sound claims made by anyone on behalf of promising means of control.

When this pest, through severe outbreaks in a small territory near Birmingham, Ala., in 1920, began to attract widespread attention a study of the life history and food habits of this insect soon convinced me that the best chances of securing a really satisfactory means of control lies in the direction of evolving some new way of using poison, so that the adults will eat of it, and of applying it in such a way that its use becomes practicable.

I had previous to that time spent 25 years in evolving improved means of insect control. With the original ideas gained in this work as a foundation to work on, I realized, further, that, if it were possible to at the same time concentrate the beetles to certain parts of fields, suitably poisoned, this would, in turn, greatly minimize the cost of control. That the beetle, for really satisfactory results cannot be combated without such means of concentration became more and more evident to me as it became known that the pest was adding the cowpea, beggarweed, alfalfa and sweet clover to its list of food plants.

In as much as the adults feed rather lightly, feed on the tips of the plants, that is, feed on the youngest and juiciest parts, and are, usually at least, readily repelled by any poison there applied, the problem of getting rid of these adults, then, to my mind, resolved itself to this: (1) Apply to the tips of the plants poison in such form that it will be eaten. (2) Find a way to put this poison on in an easy, inexpensive manner, eliminating, if possible, all waste incident to spraying or dusting. (3) Use such means of concentrating the beetles so that only a limited area has to be poisoned to clear a given location.

How this can be accomplished is described in my Circulars Nos. 164, 165, 166 and 171, 4 pages each. Price, for all four, 50 cents. These circulars were issued between July, 1921, and May, 1922. As soon as Circular No. 164 was issued U. S. Representative George Huddleston of Birmingham, was asked to take the matter up with the U. S. Department of Agriculture and have them do one of two things: Either have them endorse this method of control or show why this method should be unfit to be endorsed. As explained in my Circular No. 165, all that Mr. Huddleston had backbone enough to get out of them was the claim on their part that the method described is useful only in a limited way. As nothing could be done with Mr. Huddleston to get any results, when, to get backing, if necessary, he could have, with the scare at fever heat, easily aroused the agricultural interests of his and adjoining states and thus forced a show-down on this issue, the matter was turned over to Senator McNary of Oregon, who not only ranks high in length of service on the Senate Committee on agriculture, but, as explained in my Circular No. 165, had previous to this time been urged to take up with the Department the question of to what extent are of value certain original means of earwig control published by me in my Circulars Nos. 160 and 163. Mr. McNary was no better in getting results than was Mr. Huddleston. As for the earwig, my prediction, made to him in 1920, that the pest would spread, has come true, much of the States of Oregon and Washington being now lightly stocked, which means that unless sensible means of control, means described in my Circulars Nos. 182 and 184, are put into practice, the pest will soon show itself to be a serious country pest, and it will also thus soon become apparent to any thinking person that broadcasted poison bait, the official means recommended, is out of question as a means of controlling a pest spread over the country at large. The question as to the merit of the case has been early in December, 1923, turned over to U. S. Representative Elton Watkins, representing the worst infested part of Oregon, containing the city of Portland. He promptly made a request for an explanation. A reply from the Secretary of Agriculture, intended to fill the need of an explanation, reached him on December 20 and he reported at once to me as follows: "The Secretary stated that the Department was doing its best to combat the earwig, but that it was hamp-

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ered by a lack of available funds. However, he went on to say that an earwig parasite is being introduced and that the work will be carried on in conjunction with the Oregon Agricultural College and Washington State College."

The claim that the Department does its best to combat the earwig and is hampered by lack of funds is discussed at length in my Circular No. 184-C, and this claim is as much of a lie as is their claim to U. S. Representative F. F. Patterson, Jr., of Camden, N. J., reported in my Circular No. 185-B, p. 5, to the effect that the Japanese beetle work is being as well prosecuted as funds allow, this with the latest appropriation for \$200,000. What Representatives Watkins, Patterson and many others, including Senator McNary, wanted during many years past to do was to squeeze out of the Department an explanation of why they do not want to endorse the means described by me. As far as it rests with the Department they have no use for any means described by anyone no matter how meritorious or how much the loss is to the country because of their fighting thus all progressive measures not emanating within the Department. However, with the problem of combating the earwig, the Japanese beetle, the Mexican bean beetle and the bollweevil becoming more and more acute, on all of which, and many others, I have described methods of control vastly superior to what the Department has to offer, I have been able to drive them more and more into the corner and they are now virtually in the position of trapped rats. Mr. Watkins was told that, as the case stands now, the thing to do is to take the matter up with President Coolidge and secure an order for a show-down.

Speaking of earwigs may seem out of order here but to show how easily the pest might be carried to a southern port I quote from the Oregon Journal of Portland, of December 13 where a report states that the steamer West Jappa, inward bound from Buenos Aires, when it began to unload at Portland 100 tons of bonemeal after stopping at California points, was found to have that bonemeal alive with earwigs. The shipment was promptly condemned by the inspector and ordered back upon the vessel. At last account the boat soon after sailed away for California.

The Department is deliberately silent in regard to the fact, elucidated on page 4 of my Circular No. 171, that most

highly injurious insects, the Mediterranean fruit fly for instance, are, under primitive conditions, subsisting on a limited food supply and "are forced to subsist upon the scattered small native fruits," in the case of fruit flies, (Year book of Agriculture, 1917, p. 192) and that the injuriousness of these insects increases with the increase in the available food supply, due to artificially created conditions, and that this, in turn necessitates suitable artificial means of control. Thus, no fruit grower expects much fruit clean of codling moth attack, if the control of this insect is left to its many natural enemies.

To show that my method of controlling the Mexican bean beetle must possess more than limited value I will explain that under this method, by using nothing but easily home-made facilities, only the tips of the plants are coated and in such a way that there is no waste of material whatever, and a strip of any desired practicable width can be treated. Not only this, but the use of poison is so economical and so little foliage, as far as practicable only the tips that are fed upon by the beetles, need to be poisoned, it is feasible to render the poison so attractive that not only will the beetles eat of the poisoned foliage, but will rather prefer it to unpoisoned foliage. This, alone, is manifestly a long step in the right direction, but my system of control also provides for two entirely distinct means of concentration, thus making it possible for a part of a poisoned field to do nearly as much in the way of control than would a whole field thus poisoned. One of these means of concentration is best adapted for hot weather use, while the other, which utilizes the attraction one sex has upon the other, is specially adapted to the early part of the season or to periods of cool weather.

These means are amply sufficient to absolutely control the beetle at slight cost. However, in addition my Circular No. 164 points out a method by which the larvae could be successfully destroyed. This circular also refers to a method of trapping the adults, described in my Circular No. 160.

With these means already described by me, there is, as far as can be seen, little or no chance for the Bureau of Entomology to work out anything to take their place, hence the need for a show-down.

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Abolish Private Schools?

By Fred Reinlein, 144 West Kilpatrick Street,
Portland, Oregon

Circular No. 174-A

MAR 10 1922

July 24, 1922

Inasmuch as a parent sending his child to a private school pays for its support after paying his share of taxes to the public school fund, the maintenance of private schools relieves the general public of paying taxes that otherwise would be necessary. Private schools are maintained chiefly for two purposes: to maintain schools for the children of the rich, and to teach religion in addition to the secular matter required to be taught in public schools. To suppress the private schools as we now have them would be unconstitutional. But to amend the Constitution of the Nation and of the various States to make it unlawful to teach and practice the Catholic religion has been pronounced by the Evangelical Protestant Society, with headquarters in New York, to be their aim.

The schools of the founders of this country were denominational schools. "Be careful not to maintain the supposition that morality can be maintained without religion," said George Washington. What renders teaching of religion in public schools impossible is the intolerance of the Protestant sects among themselves. In view of these dissensions the only method of teaching religion that seems to me to be feasible is the one originally described in my Circular No. 162, now out of print, which consists in giving the children a general insight in all of the various religions. Under this plan the child is told, in language adapted to its age, by what reasons the atheist aims to defend his belief in the non-existence of a God, also by what reasons the Protestant believes in a God and each sect in its specific doctrine, also by what reasons the Catholic defends his specific belief.

Knowledge is power, but, unless secular knowledge is guided by morality, it is power ill used. All men have a moral sense inborn, just as they all have an inclination to avarice, voluptuousness and pride inborn. The absence of moral teaching in the public schools is destructive to man's inborn sense of morality, since its deliberate omission implies that such teaching is neither necessary nor to be encouraged. In competitive tests with public schools the country over Catholic parochial schools have made a brilliant showing, not so much because of a certain superiority in the knowledge of secular matters, as through having been schooled in sound logic through the teaching of religion, for, of course, a Catholic child is given the reasons by which the Catholic belief is maintained to be tenable.

Religion necessarily involves mystery. What the Catholic child is shown is that the various mysteries of its religion do not conflict with sound logic. The claims, often made by agitators to secure coin under false pretenses, that parochial schools breed disloyalty is absurd, loyalty to one's country and the fostering of international peace being necessarily part of any reasonably sound form of christian religion, Christ having enjoined his followers to love their enemies. As a matter of fact the Protestant religion is Protestant only to the extent it rejects Catholic teaching. That means that any teaching in which Protestants agree with the Catholic religion is Catholic teaching, and means that Protestantism leads logically in infidelity. The great bulk of the 65 per cent of our population not affiliated with any kind of christian religion is of Protestant descent. Lack of moral teaching accounts for the fact that the United States is first in divorce, homicide, disregard of law and various other discreditable things. To abolish the schools for the children of the rich would greatly accentuate the class hatred even now existing.

On the Need of Using Improved Methods of Insect Control

Copyright, 1922, by Fred Reinlein, 144 West Kilpatrick Street,
Portland, Oregon

Circular No. 175

July 25, 1922

Taking as an illustration the problem of protecting cotton against insects, we find that, relative to the method of controlling the bollweevil by dusting with calcium arsenate, the Bureau of Entomology makes this statement on page 17 of Farmers' Bulletin No. 1262: "You should not poison if the cost of calcium arsenate, the cost of labor to apply it and the depreciation on the dusting machines will total more per acre than the current value of 100 pounds of seed cotton. . . ."

That means that poisoning, under these conditions, is admitted to be not profitable. One of the several conditions necessary for profitable poisoning, as given on page 16, is that "the land is sufficiently fertile to yield at least one-half bale per acre with weevil injury eliminated." The humbugology of the Bureau of Bugology comes in through their deliberate ignoring the fact that, besides the bollweevil, the cotton is attacked by many other insects now well established, and also by fungi, most of which are not amenable at all to the poisoning as advocated, and thus call for additional expense for control, if a half bale yield is to be secured with weevil injury eliminated. Hence the need for means of control that are really practicable. Such means are described in my Circular No. 174. Moreover, it is certain that, in addition to the pests that now affect cotton, two pests of first magnitude will infect cotton within only a few years. They are the pink bollworm and the European cornborer, means of controlling which are given in my Circulars No. 172 and 174.

The need of better means of insect control is great in all lines, but it is nowhere greater than in the protection of our forests. On the whole, what methods of control are now officially advocated are crude and expensive, if of any use at all. Moreover, it is practically certain that some

of these insects, especially the pine sawflies, make possible the spread of the white pine blister rust, and probably of other cankerous diseases. As far back as 1918, on pages 26 to 32 of my Circular No. 152, I showed pretty conclusively from evidence given in Farmers' Bulletin No. 742 that the trouble known as white pine blister rust is essentially a bacterial disease and is carried about by insects and that the diseased part serves as the breeding ground for the hibernating form of a fungus disease, which during most of the growing season lives upon currants. I showed this more clearly on pages 1 to 16 of my Circular No. 158. Since then additional evidence given in Department Bulletin No. 957 makes it possible to still better prove this contention. While it is there shown that sporidia that have developed from teliospores that matured on currants during summer and fall can enter pine leaves through their stomata and start a mycelium down to the twigs, it is also conceded that pycnial drops always must develop in the infected spot before the mycelium started by one of the sporidia can produce, and only in this same spot, aeciospores, which in turn infect currants. These pycnial drops contain the pycnosporos. It can be taken as manifest, then, that the pycnial drops can be produced only by pycnosporos getting a chance to start the disease. The sum of evidence now available tends to show that these pycnosporos, to develop the disease, must, usually at least, find a spot where the tissue has been weakened, or becomes weakened within a certain time, by the development of mycelium springing from one of the sporidia given off by teliospores. Possibly these pycnosporos can develop the disease also on parts of the bark weakened by other fungi, or by insects, or in trees that have used up most of their vitality. The pycnial drops have a sweetish taste, evidently provided by nature to attract insects. Pine sawflies, thus, will visit white pine to lay eggs into their leaves. In going about a tree carrying pycnosporos, it appears certain that at least some of these sawflies will sip on the pycnial drops and carry pycnosporos on their bodies to other parts of this same tree or to other trees. In ovipositing these pycnosporos seem then to be able to either enter the tissue direct through the slits made by the insects or they may fall on a moist leaf and enter

the tissue through the stomata. Hence we must conclude that unless the tissue is weakened by the parasitic fungus which in summer produces the uredospores on currants, the pycnospires can ordinarily not develop and cannot, in turn, produce pycnial drops ahead of aeciospires.

That means that the destruction of all currants would prevent successful infection by pycnospires where otherwise infection would be successful due to the weakening effect of mycelium developed from sporidia that had come from teliospires produced on these currants. It means, that, if the currants were not destroyed, but if all pycnial drops were destroyed as they would through cutting out the cankers or, a much more practical way, through searing the canker sharply with the flame from a hot air blast torch, as described on page 6 of my Circular No. 173, the bacterial disease could not develop, nor would there be any suitable tissue on which aeciospires could develop. It also means that if all insects that carry the pycnospires to new locations were destroyed, the disease could not spread. For best results from a given sum spent in control all these three means should be carried out as far as is practicable.

The Bureau has no means to offer to kill the pine sawflies under forest conditions. For their control some of the methods originally described by me on pages 26 to 30 of my Circular No. 161 and on pages 20 to 37 of my Circular No. 160 for the control of the highly injurious European pine shoot moth, the white pine weevil, borers and other forest insects become applicable. Some of these methods are briefly described in my Circular No. 173. More important just now is the gipsy moth, which is greatly extending its range. Most of the \$600,000 appropriated for preventing the spread of moths for 1923 is intended to be used on practically ineffective methods, claimed to make it possible to effectively control this pest. The Bureau has no means of control, feasible under forest conditions. One of several that are feasible was given on page 30 of my Circular No. 160. It consists in collecting pupae and in using caged virgin females to attract the males. Such pupae can be had in quantity by tying burlap bands around the tree trunks at pupation time. The larger of the pupae will produce fe-

males. These can be exposed, preferably with some water into which some fermenting sweets have been stirred, in cages having double screens, to prevent mating, the males attracted to be poisoned by a suitable liquid in troughs running around the cages. Bugologist Howard and his boasted experts could not see that if pupae were thus taken outside of the known infected territory, the use of caged females would, through attracting males, show up the presence of the pest. Thus the "colony" at Somerville, N J, was not discovered by the blind bats till the pest had spread over 300 square miles. Another method, the use of a traptorch, discussed in my Circular No. 174, p. 4, was specifically shown to them on page 20 of my Circular No. 160, issued October, 1920, to make it possible, in a practical way, to detect the presence of insects, attracted to light. Circular No. 174, in addition, describes a method of trapping by exposing caged adults on a platform coated with sticky material. These methods, put into practice, will save hundreds of millions of dollars when used to trace the spread of the pink bollworm, the European cornborer and the Mexican bean beetle.

The use of caged adults in connection with the exposure of poisoned sweets becomes of special value in the control of diurnal insects, since these cannot be concentrated by the use of light at night. Thus, on page 4 of my Circular No. 170 I showed that inasmuch as the Japanese beetle, a highly destructive new diurnal pest, has a wide range of food plants, including many trees growing wild and many weeds, practical control measures must include a method of concentrating the adults. This I showed can be done only effectively by exposing caged adults separated as to sexes and exposing poisoned sweets around the cages among specially attractive food plants, which also are to be properly poisoned.

Chief Howard, having deliberately dodged all the issues in the past, is clearly a low down scoundrel. Ours is boasted to be a Government of the People. If so, Chairman Haugen, of the House Committee on Agriculture, must have a right and a duty to insist on an explanation. But he says he has not. As the case stands, then, it is up to President Harding to order a show-down, since, after all, the personnel of the Exexecutive Departments are his own boys.

On the Control of Grain Insects

Copyright 1922, by Fred Reinlein, 144 W. Kilpatrick St., Portland, Ore.

Circular No. 176

September 30, 1922

Although both the European cornborer and the Mexican bean-beetle, two pests that have attracted much attention of late years, are not grain pests in the sense we use this term when applied to the "black weevil" or the Angoumois moth or other insects feeding upon ripening or mature grain exclusively, they very largely do live upon grains, and as admittedly their spread over a very much larger territory than now infested is but a matter of a few years, and as they in the southern part of the country can produce from 3 to 5 broods, it becomes interesting to see to what extent means for their control thus far devised might at the same time serve to combat grain insects proper. For the control of grain pests proper very little in the way of control has been officially suggested beyond the prompt gathering of the grain and fumigating it. But the prompt threshing of wheat or the prompt husking and shelling of corn in such quantities as would be needed for the best interests of the country is largely an impossibility. It is evident, then, that it is desirable that practical means of controlling grain pests during the growing season be devised, since this then would more or less eliminate the use of the only other means, rapid storing.

In attempting to devise means for the control of the European corn borer and the Mexican bean beetle, as given in my Circulars No. 171 and 172 and in previous circulars, I took the position that to be really effective they must make it possible to attack these insects successfully during the growing season. Circulars No. 171 and 172 briefly describe means that accomplish this end. It is also shown there that these means are adapted to the control of a very wide range of other insects, including certain grain pests and the corn-ear worm, this having been shown specifically as far back as my Circular No. 167. To illustrate: One of the impracticable means by which the U. S. Bureau of Entomology proposes to at least partly control the "black weevil" on growing corn consists in attempts to breed a strain of corn that has a long tight husk, since, as a rule, then the black weevil would not enter the husk. But the cornearworm eats out

channels through the silk, thus giving easy entrance to the black weevil, the Angoumois moth and other pests. Besides the pink cornworm and certain boring grainbeetles also provide many such or similar entrances. The European cornborer, on corn, also very frequently does this. During moderately high temperature, inside or outside, as long as a food supply is available, the black weevil, the Angoumois moth and many other grain pests (Farm Bull. No. 1029) develop a generation in 5 weeks; thus "in heated warehouses or rooms there may be as many as 10 to 12 generations of the Angoumois moth" (F. B. No. 1156, P. 7).

Thus it will be seen that with a female of these grain pests on the average laying 200 eggs, such a female in 4 months of hot weather is the potential progenitor of 200,000,000 worms, and all kinds of grain are attacked. It will readily be seen that if a practical method of combating these insects in the field during the growing season, especially when multiplication is greatest, can be devised, there will not be any great need to hurry the gathering of a crop that would otherwise usually have become heavily infested and that if stored during the then as yet warm weather is very much subject to damage through heating because of the presence of the worms, thus causing much work and expense in destroying same. To illustrate: Let us look at some of the chief insects affecting corn, its seed, its root, its stalk and its ear. On page 42 of my Circular No. 160 I called attention to a severe attack on planted corn by the "black weevil" (*Calandra* (*Sitophilus*) *oryza*), there called the riceweevil, from a record given on page 101 in Entomology Bulletin No. 38, New Series, and suggested that trap-patches be sown repeatedly and poultry given access to pick off the beetles while scratching for the corn, while the main crop can be planted with corn that had previously been mixed with sawdust moistened with creosote or kerosene, driving the weevils to the trappatch. I quote: "Only a few bollweevils were observed (in cornstalks) in comparison to thousands of the riceweevil... cornstalks... form a favorite winter home for this insect. Thus... the careless farmer has to contend not only with the weevils that are present in his corn when planted, but with others that come out of cornstalks... Mr. Schwarz... related having seen long uninterrupted rows of these beetles on fences when warm weather tempted them from their places of concealment. Mr. Schwarz brought with him... cornseed... showing the holes made by... this insect, which ate out the germ....

weevil in the field. A good illustration for the need of developing this system was shown to Chief Howard on page 34 of my Circular No. 160, issued in October, 1920, in connection with the need of properly controlling the nutweevils, also of wood and barkboring insects, the official means for these being virtually worthless for large scale work. I showed that practically all the nutweevils are strongly attracted to light and that the trouble in failing to trap them in the past was due to employing radically false principles. Meanwhile the Bureau of Entomology admits they have no practical means of controlling these weevils, and such means as they use for other nut tree pests require for application ground level enough to permit of using spraying machinery, when what we need is a system of control that will make it possible to clothe steep hillsides with nutbearing trees.

Many grain pests are but little amenable to trapping by a torch and others not at all. Taking the problem of protecting corn against insects in general I began to show in my Circular No. 156 in connection with means of controlling the European cornborer that since most corn pests especially favor sweetcorn, if at suitable times a traptorch, or poisoned sweets, or caged adults, used singly or in combination as conditions may make it appear most advisable, be located in an attractive patch of sweetcorn, the power of the sweetcorn to concentrate the pests becomes greatly accentuated and a very large part of them can be killed by these means. To take care of most of those not readily killed by these means I showed in my Circular No. 167, pp. 3 and 4, that it is feasible to coat the tassels and the upper part of the plant with poisoned sweets and also that it is feasible to poison the silks with poisoned sweets, discussed on page 2 of my Circular No. 172. It is known in a general way that with corn in prime silking and tasseling condition vast numbers of adult insects visit them, day and night, especially at night. A trappatch of sweet corn as above suggested would largely protect all the corn planted while, when the field corn is in most attractive condition, this same procedure should be applied to various parts of such fields as frequently as circumstances may seem to warrant. The aim you see is to do away as far as possible with the need of treating the whole field. These poisoned tassels and silks, being sweetened, can be assumed to attract the bollworm moth more than they otherwise would, and the eggs laid by the moths are very largely deposited on or near the silk, which means that the hatching young mostly enter there and will be poisoned.

reasonable evidence of misuse of funds, but Chairman Haugen, of the House Committee on Agriculture, did not secure any explanations.

The means in question are pretty exhaustively discussed in my Circulars 171 to 175, as applied to the Mexican bean beetle, the European corn borer, the elm leaf beetle and similar tree insects, the bollweevil, the pink bollworm, the Japanese beetle, the gipsy moth and similar tree pests. To control the grain insects these methods merely need to be slightly further developed to secure proper results. To illustrate: Billbugs and other adults readily attracted to light are usually most effectively controlled by the use of a blow torch used as a trap at night as described on pages 3 and 4 of my Circular No. 174. This trap eliminates the use of kerosene with its repellent smell, as generally employed in the past, and, by the use of fermenting sweets, generates an inviting smell that suggests the presence of sexually stimulating food. Also on pages 28 to 34 of my Circular No. 160, briefly referred to on page 4 of my Circular No. 173 and page 3 of No. 172, I showed how many adults, especially of the larger beetles, could be trapped alive. I showed that this then gives material to cage males and females, of many varieties, separately in cages provided with double screens to prevent copulation through the meshes, and, by supplying these with sexually stimulating food, it is possible to draw the insects to these cages, day or night, and kill them by exposure of poisoned sweets, either in troughs running around the cages or applied to preferred food plants near by, or, what is usually best, by using both of these methods. If an insect is diurnal as is the Japanese beetle and the Mexican bean beetle, as also all butterflies, the adults for this purpose have to be gathered by hand. To illustrate: Under date of August 15 the Oregon Journal of Portland reports the presence in the Catherine creek country near La Grande, Ore., of millions of white butterflies so that "it looks like a snowstorm at a distance," laying eggs on young timber, especially fir, and "they get right into the growing portion of the trees." Nothing is known of any proposed official means of control. One of my ways is to catch a goodly number of these butterflies, separate the sexes and attract the rest to poisoned sweets at these cages. Also virgin females can be, probably in this case, bred as described on page 3 of my Circular No. 175.

The use of a trap torch as referred to appears to be the only feasible means to control the beanweevils and the pea-

It is now in order to advise . . . destruction of the cornstalks . . . This is a measure of the greatest value . . ." On the other hand you read on page 15 of Farmers' Bulletin No. 1029: "... many believe that some of the weevils live over winter in neighboring woods . . . corn maturing on rows nearest to the woods . . . is usually more seriously infested. . ." Thus the "careless farmer" is not likely to come far by destroying cornstalks. The truth is, Chief Howard the old fossil, has for years deliberately ignored every new method of controlling insects shown to him by me, methods that, instead of calling for the destruction of ground covering, make use of such ground covering for the concentration of insects there and for making war on the injurious ones there before they multiply and spread.

The sprouting seeds of corn may be attacked and destroyed also by a number of other insects, while the young plants may be stunted or destroyed by others, some being the southern cornleafbeetle (Dept. Bull. No. 221), the rough-headed cornstalk borer (Farm. Bull. No. 875), billbugs (F. B. No. 1003), wireworms (F. B. No. 733 and F. B. No. 725), cutworms (F. B. No. 739), the southern cornrootworm (F. B. No. 950), the cornroot webworm (F. B. No. 1258), while the somewhat older plants may be infested by various corn-borers, related to the European cornborer, and by many other insects. When corn begins to set tassel and silk it becomes specially attractive all around and it is then that grain insects proper, such as the "black weevil" (F. B. No. 1029), the Angoumois moth (F. B. No. 1156), the pink corn worm (Dept. Bull. No. 363), certain grain borers and other grain pests (F. B. No. 1260) come to attack the developing grain. These adults, in the south, as in the case of the "black weevil" shown, have largely hibernated outside and began feeding and multiplying with the formation of seeds on grasses, fall sown legumes, winter oats and wheat. I described means of controlling them while thus multiplying, but part of the time Blind Bat Howard claimed he could not see them at all, while at other times he told members of Congress, aiming to shake an explanation out his bones, that the methods were of no use, and at still other times he claimed his staff had worked out the things claimed to be original with me, being always careful to give no details since that would give me a chance to hook a rope on his hind leg. All this was done through the office of the Secretary of Agriculture. Congress appropriates the people's money and, consequently, is bound to listen to and investigate any

Moreover, the adult grain pests, like the black weevil and Angoumois moth, must also be assumed to feed upon the poisoned sweets and get killed, as do the young that hatch from eggs they may have deposited there. By keeping up planting of small patches of corn, sweet corn, sweet sorghum, Milo maize or other suitable food plants for traps, it is possible to keep down up till cool weather practically all grain pests including some troublesome bugs, which are also likely to sip of the poisoned sweets during daytime when these sweets are as yet wet with dew. These means of control then make it possible to let the corn stand in the field long after mature and this enables the farmer to work the largest possible acreage with a given outlay for help. This plan makes feasible the use of inexpensive open cribs in the fall and winter, the corn that is to be held till the next crop comes on can then be husked and shelled at convenient times, and can then be profitably protected by tight bins and fumigants. Because of the shrinkage of the lumber these bins are difficult to keep gastight. The exposure of poisoned, preferably fermenting, sweets on top of bins that are not tight will act as a steady means of destroying most of the adults that emerge and is likely to prove, on corn, to be a cheaper means of protection than the use of tight bins and fumigants. During warm nights a lantern kept lighted and stood in a rather deep pan that has been coated with a sticky substance made of rosin and castor oil would, if set on top of the grain in such bins, attract and trap insects that are not disposed of by the use of poisoned sweets alone. In barns, if there is a closed window, insects are liable to try to get out there, both day and night, and if both poisoned sweets and sticky surfaces are there exposed many will be systematically destroyed at slight cost. In barns and storage rooms that are not tight enough for fumigating, if a little sulphur be burned sometimes, this will temporarily drive the insects to the windows and results in greater catches than there would otherwise be. And the smell would tend to drive emerging adults away through cracks. All this must of course be done with due precaution.

Beginning with the issuance of my Circular No. 171 in May last the attention of President Harding was called to the foul record of Secretary of Agriculture Wallace and Chief Howard, but there is nothing to show thus far that he has taken a good look at their stinky hides.

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Ag. Sem.

Handwritten signature

The Cause and Cure of Social Unrest

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Circular No. 177

October 14, 1922

With man constituted as he is, there is no prospect that social unrest will ever be entirely absent. At present there is much social unrest and the tendency is towards more. The cause for the present unrest is generally held to be the centralization of the bulk of the national and international wealth within the hands of a comparatively few; in our country 60 per cent of the national wealth being considered to be held by 3 per cent of the people. Such centralization of wealth, of itself, does not necessarily need to cause unrest. It is thinkable that it might have happened that the majority of the wealth had found its way into the hands of a comparatively few without any apparent injustice to the rest, and that the owners of that wealth, of their own free will, are aiming, through generosity towards their less favored fellow citizens, to bring about a more equal distribution. This certainly should, in this case, be their aim, if they wanted to love God above everything and their neighbors like themselves. In actual life we readily see, however, that both the bulk of the rich and the bulk of the poor have been and are now worshipping the golden calf, and that this is what really causes the unrest.

The real cure for social unrest consists in following the teachings of Christ. "Blessed are the poor in spirit," both the rich and the poor not attached to the things of the world as such, but only looking upon such possessions as means to better serve God and man—"for theirs is the kingdom of heaven." Since you cannot make people religious by law, and since it appeals to man's carnal desires not to follow Christ's teachings, we have to look around for what might be done by law to secure a more equal chance for all men, to secure at least the necessities of life.

It is estimated that if all wealth in this country were equally divided there would come to each person property valued at about \$3,000. Thus a family of six would get \$18,000. Suppose this were done, how long will it be,

quite aside from some being old, some young, some much, some little gifted, before some will form a pokerchips company, others a hootch ring, still others a narcotics gang, and so on, and many would soon have used up their share, while others, having acquired it through service and frugality, are on the road to capitalism. "What then, comrade?" "Then, well, then we divide again." We have seen in Russia how this principle works out.

The only true and workable communism would rest in each using his talents as reason and conscience dictate. This leads to a common belief in a God and in a revealed religion. Taking this for the present as proven, we find that man's real calling in this world is to serve God and love his neighbor like himself. But to follow this calling involves a willingness to practice moral restraint; that is, this system cannot be carried out unless all are willing to curb their natural leaning to avarice, voluptuousness and pride. If it were generally carried out we would all have to be near saints. As saints are few and far between, we have to see what can be done by law to curb the tendency present in all of us. Civic laws, to be really effective, must be based upon divine laws. Take the divorce laws. Christ absolutely forbids divorce. Yet, under our laws you can get a divorce almost for the asking. In the matter of more even distribution of wealth we have been passing tax laws all along with this end in view. They have failed. The reason I shall aim to show, is that, on the whole, our system of taxation is morally wrong. That is, not in accordance with sound reason. And I shall aim to describe a system of taxation that is along morally sound lines.

If a man, beginning in a very small way, builds up a business of a size worth the trouble to collect money from, he is taxed, simply because he is industrious, saving and in a general way desirable. But as everyone knows this tax-money is simply added to the cost of operating the business, and who really pays the taxes is the consumer. The people this businessman buys his supplies from, be it labor or finished goods, are some of these consumers, and they, having helped to pay the taxes of a large number of other people they bought goods from, add this item simply to the cost of what they have to sell. This, in turn, increases the cost of the goods to the manufacturer. If 97 per cent of the people own only 40 per cent of this nation's wealth,

willingness to make the necessary efforts, cannot and will not produce the normal quota. But under the plan outlined you can decentralize great wealth as much or as little as the majority may desire, and, with certain exceptions, such as the mentally or physically disabled, each is given a reasonable chance to acquire enough wealth to live in frugal comfort. Inasmuch as the average man cannot produce much, frugal comfort is all the average man can expect. As shown, with an average wealth of \$18,000 to a family of six, the cold fact necessarily is that on the average you have to stretch yourself to this size of fortune, whether you want to be content or not.

No two people are exactly gifted alike. You might have been borne crippled or met with an accident that disabled you, while a neighbor of yours is exceptionally well developed physically, and you might conclude that, if there is a God, he is not just. So indeed it would appear if man were created only for the enjoyment of material things, but revealed religion tells us that such is not the case, and that temporal trials are intended by an all wise God for our best interests, especially the salvation of our souls. Most people are willing to admit that the universe cannot have made itself and be maintaining itself, and that, therefore, there must be a God. But many of these refuse to believe in a revealed religion. Masonry, for instance, believes in an otherwise unknowable Architect of the universe. But such a belief in a God does not offer any consolation to the person that in things material, through no fault of his own, has been more or less grossly neglected. It can be shown to any fair-minded person that there has been put before man by God a revealed religion. The books of the old law, as contained in the Bible, with its various historical accounts, its laws, its prophecies, could not possibly have been written by men not divinely inspired. Thus the Jews tell you that their fathers traveled 40 years in the desert in their march from Egypt to Canaan, and were sustained by miraculous food, the manna, and we have a complete genealogy from Abraham down, who lived long before this. You might call this an unsubstantiable myth, but there has never been found anything in the Bible that does not stand the investigations of science. The manner in which the Bible speaks of sun, moon and stars, for instance, does not clash with the Copernican system of astronomy, but speaks

of sun, moon and stars, as they appear to the human eye and mind without the help of the more modern optical instruments and without complicated mathematical calculations. Copernicus was a catholic priest. Enough said. Galilaeo was a devout catholic and is buried in a catholic church. The miracles recorded in the Bible have always been beyond the power of scientists to analyze them. At the time Luther started with his socalled reformation, there existed substantially only one kind of Christian teaching, the teaching of the Church of Rome, the various sects not acknowledging the leadership of Rome being shismatics, which held then, and hold now, all the essential doctrines of the Church of Rome, excepting the acknowledgement of leadership of the popes as successors of St. Peter.

Luther started his "reforming" originally with pointing to abuses, practically all of but little consequence, of the discipline of the catholic church, of which he, as a monk and priest, had sworn to be a devoted member. The direct cause for starting this kind of reform was the fact that Luther had considered himself to be slighted by his superiors through others being preferred to him for certain work. All the same, all evidence of need for reform in discipline was willingly and duly considerel by his, the catholic church. But soon Luther also attacked the doctrine of the church. Now, while even "the just falls 70 times a day" and thus all members of the church, lay and cleric, fall more or less daily in discipline even when trying their best, the doctrine comes direct from Christ. "I have prayed for thee, Peter, that thy faith fail not." And with the beginning of Luther's reforming the catholic doctrine, he began in reality his deformation, for, of course, Christ's doctrine cannot be in any need of reforming by man. The jews had a divinely guided teaching body to explain to them the meaning of their sacred texts. Christ, by special prayer, guarded Peter's and his successors' faith against error, and Christ also sent to his apostles the Holy Ghost "who will teach you and abide with you." Luther's promulgation of the doctrine of justification by faith alone and of private interpretation of the gospel, made it possible for anyone to call himself a christian and at the same time justify doing about anything he wanted to do. A foul excuse for the greatest of crimes is always easily found. Brother Henry VIII promulgated a thing or two relative to divorce, and

others kept up the reforming along other lines. The result is, we now have about 300 protestant sects in the United States alone, and, from the nature of the case, none of them can withstand the attack of sound logic. But they exist because they teach a more or less easy form of religion, subject to individual interpretation, which, in the last analysis, does not interfere with the world, the flesh and the devil, and which appeals far more to the carnal man than does the teaching of the catholic church, which includes the observance of "all things I have commanded you." This teaching, however, is proven to be divine, even in our day by miracles. For instance, there is now living in Italy a Capuchin monk bearing the sacred stigmata. This means, that the person thus divinely favored had the willingness and desire of offering himself as a living sacrifice of reparation for the neglect shown to Christ by the world. Can you explain it by natural means? There were, in centuries gone by, about 12 persons before him thus favored. Is it just accidental that they all professed the catholic faith? The case preceding the one mentioned is that of Anna Catherine Emmerich, dead now about 100 years. She gave in visions descriptions of happenings in the life of our Lord, described locations in Palestine and Egypt she had never seen or heard of and her descriptions matched the actual facts. Her cannonization process is now under way. There must be at least four miracles proven before a person can be cannonized in the catholic church. The cures at Lourdes, in France, are all due to the intercession of the Blessed Virgin, invoked as the Immaculate Conception. If you can prove that any of the cures officially recognized are fakes, there is big money in it for you. There are similar miraculous shrines in Spain, Italy, Germany, Austria, Poland, Mexico and elsewhere. The destruction of about 30,000 persons by a sudden eruption of Mt. Pelee, in Martinique, about 20 years ago, to the man knowing no details and not believing in a just God, may seem to be nothing but the action of natural forces, or, at most, the act of an unjust God. But the fact is the bulk of these people were of catholic training, and had repeatedly grossly insulted Christ hidden in the consecrated Host, and miraculous warning of their impending destruction had been given them. If these things are new and interesting to you, for further details see a catholic layman or priest.

\$10,000 apiece, and an inheritance tax of 10 per cent or more, since most of the revenues are to come out of inheritance tax assessments, would seem to be about right. Suppose there are only five children. These will be left well enough off after paying 15 or 20 per cent, while if there is only one child the rate could well be 30 to 40 per cent. Suppose a man leaves an estate of \$200,000, a wife and ten children. Then \$100,000 might go to the wife as a half interest in a joint property of \$200,000, and \$100,000 goes to the children, less taxes as described. When the wife dies, the process is repeated. The greater the number of children, the greater will be the tendency to decentralization of wealth. As the estates increase in value the percentage of taxes should increase also. An estate of \$100,000,000, with ten children, might be taxed 50 to 75 per cent, and with one child 90 per cent.

Under this plan the Government gets hold of large chunks of estates, and the Government will be in a position to do a very great deal to give poor people, unable to get work at anything else, but willing to work, a chance of steady work in competition with everybody else and receive pay according to their ability to earn, to open up, for instance, lands held for speculation. Preference, all other things being equal, could be given to families with the larger number of children, or to people partly disabled.

This same idea can be carried out in factories and all other business enterprises. To make this proposition a success, all concerned must aim to live up to the golden rule. If they all want to do as much grafting as possible, this or any other proposition, no matter how good in itself, must necessarily fail, and, inversely, any other system, the present concentration of wealth for instance, would not, of itself, present any difficulty to general happiness. In other words, the problem, in the end, is a moral one. Unless the peoples of the earth come to learn and aim to practice faithfully that man's real business in this world is to "first seek the Kingdom of Heaven," there will never be any general contentment, national and international. You cannot lift yourself on your bootstraps. The average man cannot produce much. Hence, at best, he can expect of others only as much service in return as he produces. Some, because of greater ability and willingness to make the efforts, can, and should, produce more, while others, because of less ability and less

they certainly, in securing the necessities of life, pay nearly all the taxes, not directly, but indirectly, and nothing essentially better can be expected under the present system.

Not all the taxes, however,, that are now levied are based upon this wrong principle. These are the inheritance taxes, and, in a much lesser degree, the luxury taxes. When we levy an inheritance tax, we simply decree that a certain percentage of the inheritance is to go to the Government. What I intend to show is that, if taxes are to be imposed upon those most able to pay, we have to secure most of our taxes by the inheritance tax route. In my Circular No. 162, issued in March, 1921, I described this method of raising taxes for the first time and for illustration of the soundness of the principle involved, I called attention to a case where a young navy man, earning \$40 a month, fell heir to 23 million dollars. The first thing that bothered this young man was how to get rid of his job in the navy. If the person who left the money had been interested in him, he would most likely not have left him to shift for himself. Under the law the money simply had to be dumped upon someone in some way related. Suppose the person that left the money had willed it to charity, the young navy man, having done nothing to earn it, would not have missed the money any more than you and I, but thousands of needy people could have been greatly benefitted, and the tendency to social unrest would have thus been relieved to that extent. Usually there are children, or brothers and sisters, or nephews and nieces to whom such money goes, less the inheritance tax now imposed. An estate to be divided among heirs does not, as such, represent an active business. It represents accumulated profits left by the deceased. There is no getting away from the fact that these profits came, fair or foul, no matter just now, out of the pockets of the people, and the mistake we have been making in the past was our failure to place amply heavy taxes where there is the most wealth available in the easiest, safest and surest form. This tax, I showed, should not only be graduated as to wealth, but it should also take into consideration the number of children the deceased may have left behind, the tax being the lighter the more children there are.

To illustrate: We have an estate worth \$100,000 and there are ten children. Since the average wealth per person is \$3000, these ten children are well above the average at

If you are one of the 65 per cent of our population that is not affiliated with any kind of a church, did it ever occur to you that, if you want to claim to be willing to love God with your whole heart, you owe it to yourself, to your children and the world at large to investigate all these matters? That without a knowledge of this all your activities are merely directed to a worldly end? That our public school system ignores this matter entirely and, in practical operation, because of this, tends to break down morals? "Who is not with Me is against Me, who does not gather with Me, scatters." That history must be given in accordance with facts? That it is false to tell the child Luther and Henry VIII were reformers? That you cannot implant morality without teaching religion? That to be just to all taxpayers and give the children moral training, the children should be shown on what reasons the catholic, protestant, jewish and other religious beliefs rest? That the public school curriculum, in not providing for instruction in morals and religion, does not only not provide a complete education, but in teaching history, as far as it refers to persons like Luther and Henry VIII, usually, if not always, does not give the true facts? The children see their elders read, write and figure all along. We are not satisfied to let them pick up this knowledge without special training in schools. On the other hand a great many children never hear their elders advocate religion of any kind. Is not then the need of religious training in schools really much more greater? Do you not then realize, that, inasmuch as the bulk of our private schools are denominational schools, maintained free to the general public, the catholics alone thus saving the public 123 million dollars a year, this sacrifice is brought by catholics, protestants and jews in support of their religious convictions? That moves to suppress them are necessarily atheistic in character, no matter how skillfully attempts may be made to hide this fact, and that the Towner-Sterling bill and other proposed educational and "welfare" measures in Congress, from their nature as national measures necessarily more expensive and less productive to the taxpayers as a whole than are corresponding state and local measures, are designed to serve the same purpose, unless they specifically provide for religious education, which they deliberately avoid to do. "Without Me you can do nothing." "I am the Way, the Truth and the Life." Think it over.

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no.183-A

The Boll Weevil Problem

Fred Reinlein, 144 West Kilpatrick Street, Portland, Oregon

Circular No. 183-A

January 12, 1924

A method of poisoning the bollweevil that will make it feasible to begin poisoning the plants as soon, or before, if desired, as squares are formed, do this at trifling cost by eliminating all handwork through the use of an inexpensive homemade contrivance, that eliminates all waste incident to dusting, that poisons only the tips, the place where the feeding and sipping of water is done, that is used during day time, that makes it feasible to use poison rendered attractive, that can be used frequently during the season because of its extremely low cost due to the slight amount of material required and elimination of cost of expensive machinery, a method that at the same time, because it makes it feasible to use poison frequently in attractive form at slight cost, makes it possible to control many important other cotton insects not otherwise amenable to the use of poison, a method that is used in the later part of the season in conjunction with a suitable method of concentrating the weevils, some such method of control is what the grower affected by the bollweevil has been hoping for all the time.

Well, it is here. It is described in my Circular No. 183-A, 8 pages. Send me 50 cents, and a copy is yours.

If you want any references, how would the U. S. Department of Agriculture do? The Department has known me for 26 years. I am obliged to tell you at the outset that as far as my experience goes, the Department has no use for anything, no matter how good, if it is worked out by some one other than their so-called experts. Just the same, stop and think, if it is not they that is on the defensive—and they have complained for years that I “assail” them, why did they not chase the Department of Justice after me years ago? The truth is they have for years been trying to impede my attempts to place far better means of insect control before the farmers than they themselves have to offer. That means they have for years deliberately humbugged the

people with their own good money. It means that Secretary Wallace and Chief Howard are scoundrels.

Just to show how they do it: The Japanese beetle infests now a territory near Philadelphia about the size of New Jersey, and is admitted to be a first class pest. Representative F. F. Patterson, Jr., of Camden, N. J., upon my request asked them for an explanation as to why they do not want to endorse certain original means of control described in my Circular No. 185. As explained in my Circular No. 185-B, p. 6, they did not in their reply to Mr. Patterson make any reference to my means of control at all. That is, they deliberately declined to say either these means are bad, or they are good. They did not want to say, they are good, because they do not want to see anything good in anybody else, and they did not want to say they are bad, because they know I would use this as a rope to choke them up. Similarly, in a letter received just now from U. S. Representative Hawley of Oregon, they ignore all request for a criticism of my methods of controlling the European earwig and the tent caterpillar, pests of importance in Oregon. Of course such monkeyshines are bound to come soon to an end.

The method in question is a modification of a method of poisoning I originally worked out in 1921 in an effort to devise a practicable means to poison the adults of the Mexican bean beetle. This method, which for best results should be used in connection with certain easy means of concentrating the beetles, absolutely controls this beetle at slight cost. But although the pest has been greatly spreading, and all the members of Congress in the infested territory were asked to insist on a show-down, nothing was done. So, as the case stands, if you are bothered by the beetle, you buy my literature relative to the control of this insect as advertised in my Circular No. 171-A, or you go without it, and the same holds good when you are troubled with the boll-weevil. Or, else, take the matter up with your Congressman, have him make inquiry, and report to me, good or bad, no matter.

This method is of special benefit to farmers growing cotton on low-yielding land, and makes unnecessary the attempt at control by the so-called Florida method. The weak point of this method is that it requires all the control work possible for that year to be done within a few days.

their old way of dodging the issue, so a set of questions concerning the control of the Japanese beetle was printed to help Congressmen in their efforts to nail Secretary Jardine down to answer just what was wanted. No action to date. For details write for my free Circular No. 193-F, also, if interested, write for Circular No. 192-A, dealing with the very important cotton flea problem, for No. 183-A, dealing with the bollweevil problem, or free literature on any subject you are interested in.

In a communication to the press about June 30, Mr. Loren Smith, in charge of the official Japanese beetle work at Riverton, N. J., says that, of the natural enemies of the Japanese beetle which are native to the United States, the birds appear to be the most important and that English pheasants do good work along this line and are to be colonized and protected. Why not then use poultry in a systematic way under supervision of man, described as far back as 1921 by me in my Circular No. 161? Pheasants, of necessity, are on a par as to usefulness with hogs given the run to clear grub infested grasslands, they will do more harm than good. By the way my system of earwig control includes a method of using poultry to clear farms at no direct outlay of money.

The Philadelphia Evening Bulletin of June 28 carries certain spray recommendations given out by Mr. Smith. Thus in the case of early ripening apples he says certain varieties ripen so soon after the time of the appearance of the beetles that it is not recommended to spray the trees till after the crop is harvested. This is for the purpose of avoiding poisoning the consumer. These apples, then, will, especially just previous to maturity, invite wholesale infestation, hence practical destruction. Under my system sprays are not used at all, but certain of these apples and other fruits, especially wormy and diseased ones, ripening prematurely and having but little commercial value, are made more attractive and used for bait to protect the later maturing healthy fruit, this making a method of baiting far cheaper and more effective than that described by Dr. Howard in his report where he infringes on my copyrighted matter. Mr. Smith is entirely silent about the use of any bait. For further details on this point write for my free Circular No. 193-G.

Circular No. 193 is not, ordinarily, to be given out free. It is written mainly for Congressmen, showing the need of official action. However, it is also writ-

ten for the purpose of posting a certain number of the constituents of a given Congressman that is for some reason wanted to specifically take action. As U. S. Representative M. E. Crumpacker, of Multnomah county and Portland, failed to take the matter of earwig control up with the Secretary of Agriculture as I had repeatedly asked him to do, and as Seattle is rather more heavily infested than is Portland, an effort was made to have Senator Jones of Washington take up this matter. He did, but in the reply he received under date of June 29, the Bureau again side-steps all issues, making no reference at all to my system of earwig control. Senator Jones was thereupon told this would not do. A set of specific questions had been given him to be answered, copies of which may be had upon request, and these he is now wanted to insist on being answered. Meanwhile the readers of the Seattle Weekly News who will cut out this part of the advertisement are welcome to a copy of my Circular No. 193. If they send for it and carefully read it, they will learn of many new points of effective insect control and will be able to properly judge of the value of my work and in turn will be in a position to judge as to what must be expected of a Congressman under the circumstances.

Under date of June 19 the Seattle Post-Intelligencer carries a notice to the effect that Prof. Trevor Kincaid is proposing to fight the earwigs with trained toads. My method of using poultry is a many times better and more effective method than the use of toads can ever be expected to be. For details send for my free Circular No. 184-C.

Under the circumstances for Senator Jones to make a request for action does not merely mean a request on behalf of his particular constituency. It is really voicing a request that, as a matter of course, is to be concurred in by every Congressman in the country. A request by him or any other Congressman in reality means: The gang is all here. Show us a thing or two and make it snappy.

Write for free literature.

FRED REINLEIN,
144 W. Kilpatrick St., Portland, Ore.

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Seattle Weekly News, July 30, 1926.

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no. 184-11

Of course, the Bureau was wanted, as always, to do one of two things: either endorse the methods described or else give reasons why these means should not be endorsed. But as there was, as always before, no such action, not only was Senator McNary again asked to ask the Secretary of Agriculture to order a show-down, but several U. S. Senators and Representatives from the territory affected were asked to do likewise. Nothing was accomplished. Representative Gilbert N. Haugen, Chairman on the house committee on agriculture had, because of his official position, for years been asked to force a show-down, but he claimed he has not the authority to do so. If so, what is he and the rest really good for; if they cannot protect the people against being officially humbugged with their own money?

The earliest official treatise going reasonably exhaustively into the habits of the beetle and the official means advocated was published as New Jersey Department of Agriculture Circular No. 30, issued in February, 1920. It was written by Mr. John J. Davis, then assistant to the state entomologist and collaborator, U. S. department of agriculture, but Mr. Davis soon after left this service, to become chief in entomology at Purdue University, Lafayette, Ind.

A copy of my Circular No. 161 reached Mr. Davis there, and, with fostering the general good as his aim, he, unofficially, criticized my Circular No. 161, just as I had asked him to do officially, assuming he was yet in charge of the work at Riverton. On the whole Mr. Davis could see not much good in my system and inclined to the belief, that the proper perfecting of arsenical sprays represented the key to success. Mr. Davis declared my method of using poultry in connection with certain preferred food plants, properly handled, to be of no really great value, also could see little or no good in the use of baits and the use of caged adults as there described.

I concluded, that, if these means do not possess real value, or cannot be improved so as to possess real value, the chances of providing a satisfactory system of controlling the Japanese beetle are very poor. I thereupon watched the results of further tests with arsenical sprays and became soon satisfied that I was right in claiming, that arsenical sprays are on the whole useless, since they merely drive the beetles to other food not sprayed, including certain timber trees, many field crops, including corn, and many weeds. This, then, as the beetles' food habits, as published by the

Bureau, became more fully known, convinced me, that the solution of the Japanese beetle problem rests on a proper use of baits, accentuated for large scale work by the use of caged adults to intensify concentration. So much so, that I concluded that the use of poultry as described in my Circular No. 161 is, under the circumstances, of not sufficient value to be recommended for general practice, and in my Circular No. 185, published in August, 1923, I so stated.

At that time the first New Jersey congressional district was, as it is probably also now, the one most heavily infested. So I submitted a copy of my Circular No. 185 to U. S. Representative F. F. Patterson, Jr., Camden, N. J., and asked him to take the matter up with the Bureau. This he did, but the Bureau in their reply talked about what they are doing and deliberately dodged the issue by making no reference at all to my system. For details see my free Circular No. 185-B. Mr. Patterson refused to take further action. For my part I protested about his failure to secure a show-down in the press of his district. Mr. Patterson was up for renomination this year and failed to get it. His record in this matter may be partly responsible for this.

President Coolidge has ever since he took office wanted to order a show-down. No action. The present Secretary of Agriculture, Mr. Jardine, told us upon taking office he was a go-getter, but he never ordered a show-down.

In his report for 1925 Chief Howard, who had plagiarized certain of my published matter for about 20 years, plagiarized my system of Japanese beetle control by there recommending the use of bait in Japanese beetle control as something original with him or his Bureau. I thereupon concluded the time had come for due action. So in my Circular No. 193 I gave a review of all of my work since 1898, dwelling on my improved methods as they affect especially the control of the bollweevil, the cotton flea, the European corn borer, the Mexican bean beetle, the Japanese beetle and timber insects in general, a circular of twelve 5x8 pages, written chiefly to give a clear insight of the situation to all those that ought to take official interest in this matter, which includes every Congressman in the country. U. S. Senator E. I. Edwards took this matter up with the Secretary of Agriculture, who in his reply denied that Chief Howard had infringed on my copyrights, and claimed that all of my various methods of control have only a most restricted value. This was simply

charge having been made by me for years, that Chief Howard, in withholding endorsement where endorsement is due, is not only trying to foist on me a raw deal, but is also handing, in consequence, deliberately a raw deal to the public, and is therefore an out and out scoundrel. Not only this, but as will be shown Chief Howard has repeatedly infringed on the copyrighted matter I control.

The people of Seattle and Portland and of many other points in Washington and Oregon have now tried out the official method of earwig control pretty thoroughly. There may be some that consider this method to be good enough, but my experience is that the people at large do not hold any such view, especially in Portland this year, where after having been compelled under the penalties of the law to spread bait in May, even those that have baited more than once then are now required to spread bait again in July to "get the second brood," as officially declared to have been emerging by July 1st. One party in Seattle writes me under date of July 15, she has been working very hard for the last three months to clear her place of only 78x100 feet, and still there are quite a number of earwigs. She says, she used regular earwig bait, apex, coal oil and boiling water, the hot water being about the most effective, but it killed nearly all of her plants and shrubbery. Address may be had through U. S. Senator Wesley L. Jones. Hence, these being rather fair samples, anything reasonably promising of giving even only slightly better results was entitled to receive proper attention on the part of the U. S. Bureau of Entomology.

After having been working out and publishing improved means of insect and fungus control for 22 years, I realized that some of the improved means I had been able to work out during this time make possible, by judiciously utilizing the habits of the earwigs to concentrate largely about the most attractive food within reach, and hide as far as possible near it when not feeding, a far better and cheaper control of the earwig than does the use of broadcasted bait, and described such means in my Circular No. 160, issued in October, 1920. The matter was at once brought to the attention of U. S. Senator McNary of Oregon. Since the Bureau had for many years previous failed to take proper action relative to other means of insect control Senator McNary had been asked to get action on, he was then told the interests of his constituents specifically require that he secure a show-down rel-

ative to this earwig issue. He made a request to that end, but secured no action, nor secured action on my Circulars No. 182 and 184, issued in 1923, dealing with earwig control. Senator McNary claimed that nothing could be done to force the Bureau to act.

The earwig issue was not then, and is not even now, attracting national attention, as did, and do now, other problems, such as the Japanese beetle around Philadelphia, the European cornborer, rapidly approaching the corn and cotton-belt, and the Mexican bean beetle, so, having long ago learned that the general public readily swallows any old gab handed to them officially, and looks with suspicion upon anything not officially approved, I turned my attention rather to these matters, especially to introducing my system of Japanese beetle control, biding my time when the earwig trouble would become acute enough to make the people more willing to investigate what I have to say.

The Japanese beetle was first discovered in the United States in 1916 near Riverton, N. J. Being closely related to the May beetles and the green June beetle, great ability for damage on its part was at once suspected, and this suspicion became quickly enough borne out by experience. The pest, in spite of millions of dollars having been spent in repression, now covers about 10,000 square miles, with a population of about 5 million people. Since the Bureau proposed to use arsenical sprays as the main reliance in control, and the insect was soon seen to be a very general feeder, its number of food plants including now well over 200 species, I at once saw that this method can be of no avail, and in February, 1921, published my Circular No. 161, dealing with Japanese beetle control and related subjects.

There was shown to be practicable 3 lines of attack, to be followed singly or combined. First, I showed that poultry could be used in a large way to control the pest; then I described various ways of using baits, including a method that will not only protect corn, but will at the same time make possible the control of many other grain pests, such as the Angoumois grain moth and the corn earworm; and last of all I showed the value of using adults separated as to sexes to increase concentration and destruction. The use of arsenical sprays, and of all artificial means to control the insect while in the egg, larva and pupa stage was declared by me as not worth the cost, not alongside the means of attacking the adults I had described.

EARWIGS

CIRCULAR No. 184-H

cannot be satisfactorily controlled with sprays or traps, according to District Horticultural Inspector P. S. Darlington, but "evenly spread bait will get them all," as quoted in issue of Post-Intelligencer of June 19.

If evenly spread bait gets them all, how does it come that with the large sums spent on bait during the past years, earwigs have steadily increased in virulence in Seattle?

Earwigs, outside, by July begin to live mostly on tall vegetation such as trees, thus to successfully attack them then, something other than evenly spread bait is needed. Also, those living about and in houses cannot be gotten by evenly spread bait.

Earwigs, as a matter of fact, are of the very easiest control, if attacked in a sensible way. Successful control, that is, control that nearly, if not quite, exterminates them at a given time and that, carried on a reasonable length of time, actually exterminates them in a given place, pending reinfestation from outside sources, and does this safely at light cost, cannot be secured through broadcasting bait for a number of reasons, one being that earwigs in their continuous search for the best available food usually by the time bait is applied have become previously accustomed to feed on materials rather more attractive than is the official bait, as for instance the stamens and pistils of wild and cultivated flowers, or aphids and the honeydew they secrete. For further details send for my free Circular No. 184-G.

Earwigs can be successfully controlled in several ways. Earwigs do not occur uniformly. They show a tendency to concentrate about the most attractive food supply, and during the cooler part of the year to select locations offering plenty of shelter. Under my system of control not only is full advantage taken of their habit to search for and concentrate on the most attractive food, but advantage is also taken, at the same time, of their tendency to hide as far as practicable near this food supply when not feeding.

Under my system, by certain easy, inexpensive means, this tendency to thus concentrate and to hide is greatly intensified. Under city conditions the best means of control, and the only means to

secure actual extermination in a given place, is the judicious use of high grade bait, bait you are shown in my Circulars No. 182 and 184 how to prepare yourself out of what usually would be wasted, bait you are shown how to use with absolute safety inside and outside, with protection, outside, against sun, wind and rain, and inaccessible to children, cats, dogs and poultry, bait that contains more or less materials of animal origin, greatly preferred to materials of vegetable origin, bait that is used in such a way that it will not readily deteriorate and a little of which will go a long way. This system is described in my Circular No. 182, price 50 cents. This system is redescribed in modified form for special use under garden and orchard conditions, so as to also make possible at the same time the control of numerous garden and orchard pests, in my Circular No. 184, price 50 cents, or Nos. 182 and 184 combined for 75 cents.

Naturally you will realize that if what I claim for the contents of my Circulars No. 182 and 184 is true, I claim to know a whole lot more about efficient earwig and, to some extent, about general insect control than does the U. S. Bureau of Entomology with all their many members and their abundant resources and you will want to know what relations there exist between the Bureau and myself.

Well, there exist, in a way, the best possible relations. The Bureau and its chief, Dr. L. O. Howard, have known of me and my work of devising improved means of insect control since 1898, their attention having been often called to certain specific issues with the request for action, this request often coming through Congressmen whose constituents were especially interested, and in no case have they undertaken to prove that what I claim is not the exact truth.

On the other hand you will readily see, that, if what I claim is true, the public weal requires that they give to any and all real improvements their hearty endorsement on their own volition, so that the public may know from official sources that I give them a square deal. It is on this latter point that there exist between the Bureau and myself the worst possible relations, the

CIRCULAR No. 184-I

EARWIG NEWS

"Investigations as to remedies for the European earwig are in charge of the State College of Agriculture at Corvallis, Ore., and the State Board of Horticulture. . . . The earwig is still a local pest. . . ."

These passages occur in a letter sent by U. S. Entomologist Howard to Senator Wesley L. Jones under date of August 13 in reply to a request made by Senator Jones on Chief Howard to pass on the merits or demerits of a system of earwig control I had wanted him to act on for 6 years past.

Instead of doing so, at least now at this late date, he passes the question on to the Oregon college people and the board of horticulture. But these two organizations, because of Chief Howard's failure to act, had been all along wanted by me to point out anything faulty in my system, if they should have been able to detect anything faulty, and they had failed to do so. And a recent special request to that end, upon Chief Howard recently referring me to them, made on August 20, elicited no reply of any kind. For details see my free Circulars No. 184-H and 193-J.

Circular No. 193-J deals chiefly with my system of Japanese beetle control. But in order to refute the lies of Chief Howard made many times to members of Congress to the effect that I have evolved little, if anything, of value, this free circular describes a method of earwig control, by the use of poultry, by which method a farmer can very effectively control earwigs on his farm without any outlay of money. Such original matter is ordinarily not furnished free. The method in question forms part of my system of earwig control. Where extermination is wanted, this method must be supplemented by other means. But the method in question is given, with proper details, to enable you to judge whether or not at least that part of my system is sound. If it be not sound, why have the Oregon college people not started to holler long ago? Send for these circulars.

These circulars freely show that Chief Howard has for many years been deliberately impeding progress along improved lines of insect control, if such progress

was not emanating from official sources. They show that Chief Howard is an out and out scoundrel.

If there were not plenty of other proofs for this contention, given in Circulars No. 184-H and 193-J, and elsewhere, it could be proved from the statement of Chief Howard, that "the earwig is still a local pest and this Department feels it (the work of investigation) is in competent hands," thus deliberately ignoring the ease with which an insect like the earwig is spread about by modern means of transportation. A mated female carried in this manner is all that is needed to make it possible to start a colony at the point of destination. Chief Howard knows this. Knows that the earwigs and cockroaches are closely related to the ants. Knows that the Argentine ant, after being a local pest in New Orleans and San Francisco for a good many years, was suddenly found to have spread in small colonies steadily through means of transportation over large areas, covering now most of the best lands of the the South and of California. Chief Howard knows, therefore, that with no quarantine enforced, and none feasible, the spread of the earwig was merely a matter of time, and that to talk of it, at this late date, as a local pest, is in reality hiding the true facts, since the earwig is now practically scattered all over Western Washington and Oregon, and recent inquiries on my part of the California State Entomologist show that "there are several small infestations in the city of Berkeley and immediate vicinity."

I had for several years pointed out that earwigs would find the climatic and food conditions in California exceedingly favorable for their development. This, of course, means that, unless these colonies are taken care of by means that really control and exterminate—and only the system evolved by me does this—the pest will rapidly spread over California. Moreover, the European earwig has shown itself to be highly destructive in New Zealand on crops and under climatic conditions very similar to those of California. Hence there is the probability that the earwig in California will be more troublesome than it is now in Oregon and Washington. Chief How-

ard knows, that unless the Oregon agricultural college people are forced to define, whether or not they have found my means of control and extermination to be all that is claimed for them, the pest is protected through official inertia. Chief Howard knows that station entomologists are appointed, or at least approved, by the U. S. Department of Agriculture, that, therefore, he has a right to ask them to report to him their findings. He knows that the earwig problem, being in reality a national question, same as the boll-weevil, the gypsymoth, the Japanese beetle, the Mexican bean beetle, the European corn-borer and many others that were promptly officially recognized as national problems, is of such importance, that there is not the slightest excuse for him not to pass on the means of control I have evolved, with the advice of these station entomologists, if he so desires.

Thus when the Japanese beetle was discovered in 1916 near Riverton, N. J., it was at once seen that the insect is related to the May beetles and the green June beetle, insects capable of doing great harm, and means of both repression and quarantine were practically undertaken at once, federal action being taken at a very early date, with a view to prevent both the natural and artificial spread. But in the case of the earwig Chief Howard has deliberately dodged the issue as to what are the best means of control for 6 years past.

Earwigs were first found in the United States in about 1911 at Newport, R. I. They have spread slowly there, the winters being too cold. On the Pacific coast they occur from some distance north of Vancouver, B. C., to points in California. That means that all the territory south of a line drawn from Vancouver, B. C., to Rhode Island is, for the most part, suitable breeding grounds for earwigs.

Another thing: For many years past, whenever I asked a member of Congress to investigate certain of my claims, Chief Howard never met any issue, but always handed out a bundle of general lies and, usually, but not always, told such member, that I am not an entomologist. Evidently he looked at this statement as some sort of knock-out drops, and with the members of Congress it was, for they always let it go at that, never requiring Chief Howard to furnish proof for his claim, that I am wrong. Senator Jones was told so twice within 2 months. Thus I decided the time had come to force Chief Howard to state just what according to his idea an entomologist is, and

what he is expected to know and to do. Therefore under date of August 26 I wrote to Mr. J. H. Davis, Secretary to Senator Jones at Washington, asking him to have Chief Howard give the desired information.

Under date of September 13, Dr. A. L. Quaintance, acting U. S. entomologist in the absence of Chief Howard, thus answers this question: "... an entomologist is one versed in the science of entomology. In order to qualify as an entomologist it would apparently be necessary to have completed satisfactory courses in entomology under competent instruction, or be generally accepted by members of the profession."

This is virtually saying, that, in order to be an entomologist, a person must have a satisfactory training in systematic entomology, that is, a knowledge of their classification based upon their anatomy. I have never claimed to possess knowledge along this line sufficient to suit Chief Howard, a man that has no use for one that wants to show him a thing or two that is new to him. I know quite enough of it to go around. In fact, how can a person reading official descriptions of insects fail to absorb enough along this line, if his aim is to work out improved means of control? So much so, indeed, that I often found it time wasted, or rather nearly wasted. The fact is, I long ago learned, that, while a general knowledge of systematic entomology may be considered to be necessary, the less you spent unnecessary time along this line, and the less you stuff your thinkbox with unnecessary details of such knowledge, the more time and chance you have for finding means of properly utilizing vulnerable points in the life history of a given insect to secure its control. This requires independent thinking. If you only are to know what some person or some book can teach you, you never work out something that is original, not unless you go further on your own account than did your teacher. And of such original means I claim, by the Grace of God, to have worked out many.

Of course such detailed information along this line cannot be any more given out free than can a lawyer, ordinarily at least, give you the benefit of his knowledge of law free, but, as an illustration of what you can expect in regard to my claims, there is given you, free, an original method of earwig control by the use of poultry, given in my free Circular No. 193-J. What is really needed, is, that Congress sift the whole matter to the bottom, and, if my claims are found to be sound—and they will be

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no. 184-I

found to be sound—make such arrangements as to make my improved methods accessible to the public at the least cost. Chief Howard never wanted to listen to this for 28 years past.

The whole profession, sticking their scientific noses together were not able to work out the easy and simple method of utilizing poultry in earwig control above referred to. And the same holds good in numerous other cases. The use of broadcasted bait, officially recommended for the control of the earwig, is quite an old method and the profession does not need to expect to get any applause for having it handed out. The majority of the users, in the city, declare it to be no good, and they do not see how it could be made to pay at all under suburban and rural conditions, and one party recently claimed in the PORTLAND NEWS that all it kills is birds. Since the official recommendations call for rather free use of the bait along house foundations, sidewalk edges, steps, posts and attractive hiding places, such bait certainly becomes attractive to birds.

Or take the Japanese beetle problem. I described a system of baiting, concentrating and destroying as far back as in February 1921. Under this system the beetles can be concentrated and destroyed in masses at slight cost. Whereas, the use of sprays Chief Howard advocates, merely drives the beetles to unsprayed vegetation, of which there is, because of the practically omnivorous habits of the beetles, always an abundant supply. For further details see my free Circular No. 193-J. Chief Howard's method is, in the last analysis, absolutely worthless. In spite of Chief Howard and his many cornfed sages, and millions of dollars spent, the pest has rapidly spread, considering that the spread was only due to the natural dispersion by flight, and long distance infestation has been virtually thus far prevented through a cumbersome and expensive quarantine. Under my system no deterrent is used. Instead there is provided inducement to concentrate, hence while there will be some spread even under my system, there is, because of the means of concentration used, far less spread, than there would be if the pest were simply allowed to spread at will, with no deterrent sprays used, as is done under the official method, to accelerate this normal spread.

Quarantines, generally speaking, are but palliative measures that can be effectively carried out only for a limited length of time. Where the interests involved are great and, apparently, the

insect is difficult to control, as is officially claimed to be the case with the pink bollworm, which, given the chance, with the official means of control to rely on only, would rank in destructiveness with the cottonboll weevil, an expensive quarantine, within reason, is justified. In this particular case, since the first specimen of the pink bollworm was found at Hearne, Tex., in 1917, about six million dollars have been spent to date in efforts to keep the pest from infecting the cotton belt. Because of infected bolls being floated down the Rio Grande from plantations in Mexico, these bolls to be swept north by the Gulf stream, there is constant danger of infection along the Gulf coast from this source.

The U. S. Bureau of Entomology has been unable to evolve any means to control this insect while breeding in the field. Satisfactory means to control this pest while breeding were described by me, along with the control of the boll weevil, in my Circular No. 183, and as those means are at the same time adaptable to the control of numerous other cotton pests, the pink bollworm during the breeding season is taken care of at very slight cost. For details on this point, and numerous other important insect problems, write for my free Circulars No. 183-A, 191-A, 192-A.

Or, take the Japanese beetle quarantine. The insect having at once been recognized as a probably highly dangerous pest, considering the inadequate means of control then available, and, having quickly demonstrated to possess very great powers for harm, quarantine has practically ever been carried on. During the 1926 fiscal year, ending June 30, 1926, before the 1926 crop of beetles and consequent spread got well under way, 419,000 dollars was thus spent in control work, 280,000 dollars being federal money. By July 24 of this year a force of 500 federal inspectors were patrolling the roads around Philadelphia, with corresponding numbers all over the infested territory, its extent being given this past June as 6,000 square miles, an estimate much too low from what we know now about territory infested. The pest was found in July to be rather plentiful in Elizabeth, N. J., only about 15 miles from the center of New York City. Thus, at that rate, we shall soon need a few more thousand inspectors— if the official system of "control" is kept up.

In a circular letter issued by the Horticultural Board on September 10, 1926, announcement is made, that the Japanese beetle has recently been discovered

in portions of the States of New York and Connecticut, and it is proposed to correspondingly extend the quarantine.

Under date of September 16 the CAMDEN, N. J., ARGUS carries a news item to the effect, that, according to official sources, the insect has been found to occur at several points between Ossining, N. Y., and New York City. Several small infestations have also been found on the southern third of Long Island, and it is known to occur at Port Chester, N. Y., and Stamford, Conn. It has also been found outside of the quarantine area in Pennsylvania at Easton, Allentown, Bethlehem, Lancaster and Harrisburg.

According to a news item in a Philadelphia paper under date of July 27, "quite a number of beetles" were then noticed at Easton. This indicates that the area infested a year ago was much more than 6000 square miles and that the pest occurs now over an area of about 15,000 square miles.

But as Lancaster is removed about 40 miles, and Harrisburg about 75, from the western line of infestation as given officially this spring, it can be now accepted as proven that a large part of north-eastern Maryland is also infested, and that the total area now infested is in excess of 20,000 square miles.

All this shows that quarantines, where

at all feasible, are in any case expensive and sooner or later become impracticable, and what we really do need is satisfactory means of control. The Japanese beetle is not at all difficult to control, if attacked by sensible means, but the necessary logically sound means of control, coming from me and not from Chief Howard's much boasted of "experts," have been deliberately ignored by Chief Howard, the scoundrel.

So, all things considered, and with numerous other similar important problems awaiting action, what to do?

President Coolidge, ever since he took office, was told in effect, that the several secretaries of agriculture he had were failing to order Chief Howard to meet the issues, and that, under the circumstances, it is up to him to order a show-down. President Coolidge never took any action.

If, from what has been said you think President Coolidge should order a show-down—and, mind you, this will not cost either him or the country one penny—use your influence as a voter and taxpayer to have the State Delegations to Congress force this issue on to President Coolidge, since, of course, it is, in the end, you who pays the freight.

FRED REINLEIN

144 W. Kilpatrick St., Portland, Ore.
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Seattle, Oct. 15, 1926.

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R27c
no. 185-D

Notes on Insect Control

Fred Reinlein, 144 W. Kilpatrick Street, Portland, Oregon

Circular No. 185-D

October 22, 1924



IN LATE years a number of dangerous imported insects have attracted attention, this the more as the U. S. Bureau of Entomology was unable to work out satisfactory means of control. However, satisfactory means of controlling all of them were worked out by me, and the Bureau was for several years wanted to do one of two things: Either admit that the means evolved are, as claimed by me, far more satisfactory than anything the Bureau has worked out, or else show this claim to be false. This Chief Howard has all along refused to do.

Of the insects in question I will mention only four: 1. The Japanese beetle, with Riverton, N. J., as starting point, spread by June, 1924, previous to the beginnings of the 1924 dispersal, over about 2442 square miles, 698 miles being in Pennsylvania and 1744 in New Jersey (p. 4, Bulletin No. 390, Penn. Dept. of Agr.). This spread would have been much greater but for the enforcement of an expensive and rigid quarantine.

2. The European earwig, occurring in certain parts of Oregon, Washington and Rhode Island, a pest but little talked of outside of these states, but capable of becoming in time as great a nuisance as is its relation, the Argentine ant, in the southern states and in California.

3. The Mexican bean beetle, a pest that had long caused serious trouble to beans in New Mexico, Arizona and adjoining states, when producing there an average of one or one and a half broods annually, but with Birmingham, Ala., as southeastern starting point in 1920, had spread by the end of last year over part of 9 states, producing an average of $2\frac{1}{2}$ broods, besides attacking there legumes other than beans, some of them occurring wild in great numbers.

4. The European corn borer, occurring during the summer of 1921 over a territory of about 7696 square miles, in three separate areas, infestations having then reached northwestern Ohio and southeastern Michigan.

By way of illustrating the need of better means of control let us first look at what the Bureau offers in the way of

artificial control of the Japanese beetle. According to press reports, when the northeast entomologists met at Riverton, N. J., about August 1, of this year the claim was officially made that "ways to control the beetle have been found." An official demonstration was put on by thoroughly spraying a bearing peach orchard. One row was left unsprayed and on these trees greenish-bronze balls, hanging from the twigs, were pointed out to the visitors. Plucked, each ball suddenly took wing, 500 or 600 beetles flying off and revealing beneath partly eaten peaches. The leaves of these trees were riddled. The leaves on the sprayed trees hardly showed a nibble and the fruits were unharmed.

But not all that is made to glitter is gold. Under this method the grower first of all has to have his peach trees well and evenly sprayed, and there are quite likely two or three sprayings necessary to deter the beetles from the ripening fruit, if no unsprayed fruit is to be available up to the gathering of the crop, as was available at the time of the demonstration test. Any cracks forming because of rains or other cause on these or other fruits, plums or prunes for instance, means that the beetles can gain access, unless another very thorough spraying is given. But not only has the grower to bear the cost of the sprayings, but he also has to remove the poison after gathering the crop. If you will examine the stem end of a peach, you will find it to make an ideal socket for the settling of the poison. This, together with the fuzzy nature of the skin, offers quite a problem in removing the poison without materially interfering with the keeping qualities of the fruit, and such fruit will always be regarded with more or less suspicion, and will bring less, possibly much less, than fruit grown outside of the infested area.

Assuming a bearing peach orchard is the center of attraction in a given location at a given time, under my system of control, as described in my Circular No. 185, price 50 cents, no spraying whatever is necessary. Under this system you are shown how you can use as special attractants peaches ripening prematurely because of brown rot, bacterial disease or insect attack. You are also shown how in the absence of suitable peaches you can use other fruit that may be suitable, wormy, overripe apples, plums or cherries, for instance. You are thus shown how to draw the beetles to food far more attractive than the fruit to be protected. Moreover, a way is shown how you can accentuate concentration to this food by utilizing the attraction one sex has

upon the other. The sexes can be separated by characters of their foretibiae (forelegs) and tarsi (claws). The necessary knowledge is easily obtained by caging some beetles and watching them at mating.

What, then, does that mean? It means that the beetles are concentrated in a given location to far more attractive food, displayed at certain points within the area to be protected, than they normally have access to. It means that they are concentrated to highly attractive food heavily enough poisoned to secure killings in masses. It means that this food is inexpensive, since diseased, wormy and over-ripe fruits are to be preferred. In the absence of such fruits stewed California black figs are very suitable. It means that by this method you protect not only the specially attractive crop, peaches for instance, but you clear the whole location of beetles, whereas to spray the specially attractive crop simply means to drive the beetles to any of the 211 other species of plants officially known (February, 1922) to be attacked. These may be field crops, such as corn or red clover, or truck crops, or orchard fruits, grapes and other small fruits, flowers, shade or timber trees, or weeds. This accelerates natural spread. As this mass of vegetation cannot be protected by sprays, it means the beetles can multiply unchecked. If this vegetation were all sprayed, this would greatly accelerate natural spread.

Incidentally, my system of control, as thus far referred to, also makes it possible to control at the same time, with but little alteration, numerous of our worst orchard pests, including borers, maggots, caterpillars and last, not least, another new first-class pest occurring in the territory infested by the Japanese beetle, and in the control of which the Bureau has shown itself to be impotent, namely the Oriental peach moth. For details see my free Circulars No. 184-A and G, 185-A-B-C, 187-A and 188-A.

The Bureau is silent in regard to means of protecting corn. Now, corn, in the aggregate, probably suffers a greater loss than any other crop. Spraying is not feasible, the crop being too bulky to stand the expense, but even if such corn could be economically sprayed, the beetles would practically confine their attacks to the tips of the ears. They, there, thus would burrow in, in common with numerous other corn insects, and any beetle killed in the attempt has in doing so formed a breach through which other beetles can follow with impunity. Under my system these ears of corn are not only protected by an easy, logic-

ally sound method, but corn, especially sweet corn, planted at suitable intervals in small patches is used to concentrate the beetles so that they can be readily killed in masses and in doing the crops at large are protected at the same time.

Latest press reports from the infested territory quote Dr. T. J. Headlee New Jersey State Entomologist, as telling fruit growers that an arsenical mixture has been discovered, composed of lead arsenate, covered with lead oleate, "which the beetle eats" and which not merely acts as a repellent, as admittedly does the poison thus far used. Assuming you coat a peach with this poison and the beetle eats through the skin to get at the pulp, same as if there were no poison, the little bit of poison eaten in getting at the pulp is not likely to hurt it. But if the poison kills it, another beetle can begin there without harm and is much less likely than the first to get enough poison to get killed, but, if killed, another beetle can begin there with less risk than the second. Apples do not hold the poison well, hence can be attacked with much less risk. The real trouble, however, is that without proper means of concentration such as I use to make my system do the work cheaply and effectively, the use of this or any other poison will always mean an intolerable expense to commercial agriculture. Moreover, without providing abnormally inviting foods, as forms part of my system, the attack will be scattered over a wide percentage of the fruits, foliage and flowers attacked, thus causing practically the maximum damage possible under the existing conditions.

An entomological expert, of the kind Chief Howard is, cannot see this, but everybody else, including every Governor and Member of Congress, can see from the foregoing, first, that the Bureau's system is essentially worthless, even with what new poison they are to offer, and, second, that I offer new principles that, in any case, call for due investigation on the part of the Bureau. Money has been liberally appropriated by Congress to investigate anything promising in the way of controlling the numerous pests my means of control have to do with, but the last thing on earth Chief Howard wants to investigate is what I want him to investigate. He knows full well, same as I do, that, forcing a show-down on my part, means the beginning of the skinning of his stinky hide.

Referring specifically to the Japanese beetle problem, numerous efforts were made on my part during the past 3½ years to force a show-down, the matter having been brought

to the attention of Presidents Harding and Coolidge, the Secretary of Agriculture and many members of Congress. These latter, in every case, were given a bundle of general statements, if not outright lies. In no case was the actual merit or demerit of my claims taken up. The last specific effort along this line was made through U. S. Representative F. F. Patterson, Jr., discussed in full on page 5 of my Circular No. 185-B.

The more the Japanese beetle and other pests are allowed to multiply in the face of the antiquated means of control the Bureau wants the public to rely on, the deeper the public will have to dig down into its jeans, for these pests increase the cost of living generally and the solution of the questions involved is therefore of national importance.

Natural control of any insect is, of course, as far as possible, to be encouraged. In the case of an imported insect this suggests the introduction of promising parasitic and predaceous insects from the native home. This is being done in the case of the Japanese beetle, the most promising now being a dextral fly and a tiphia wasp. Probably the most effective natural enemy in Japan is Mr. Jap himself. I reprint from my Circular No. 162, p. 7: "Under date of January 17, 1921, the Portland, Ore., Telegram, reported the case of a Japanese strawberry grower, asking Superintendent Childs of the Hood River, Ore., Experiment Station for advice as to how to get rid of cutworms. Mr. Childs was unable to offer much comfort. However, the Japanese was incidentally told the worms work at night and "immediately he and his family took up a nightly vigil. His course of procedure was effective. He caught four quarts of cutworms."

Thus, it would seem that, with the Japanese beetle working in broad daylight exposed to the sun on Mr. Jap's food plants, especially soybeans, the job of disposing of them, with each grower and his family directly interested, and all fairly good land carefully worked, is taken care of without anybody wasting any thought about its being a pest of consequence, this all the more as the beetles make a good addition to chicken feed. But in this country, with most women wanting to be queens, princesses, movie actresses, and so on, it costs a lot of money to do such work with hired help. In the case of cutworms, unless you use improved means such as are referred to in my free Circular No. 187-A, you have to see what is the night rate of the bug pickers' union.

On page 3 of my free Circular No. 184-C: "Natural Enemies in Earwig Control," I pointed out that for several years after boll weevil entered Texas it was practically free from parasitic and predaceous insects, but now the Bureau admits that "fields showing from 50 to 75 per cent of the weevils killed by (native) parasites are by no means rare." (Farm Bull. No. 1329, p. 11.) Another case: To fight the San Jose scale, Chinese ladybird beetles were brought over at a cost of about \$2000 each. But it was later found that the native varieties accustomed themselves to feeding voraciously on this new pest. Still another angle to this question: As the European corn borer reproduces itself, or, anyway, can reproduce itself, on practically all hollow-stemmed plants of good size, the Bureau admits that the European corn borer would attack cotton once it became established in the cotton belt, tests by the Bureau in Massachusetts having actually proven this. The first infestation, found near Boston in 1917, was not discovered till it had spread over a territory of at least 100 square miles and had admittedly developed for at least 7 years, thus permitting the unrestricted carriage of infested material. Similar conditions were found in 1919 around Schenectady, N. Y. Thus the pest may have been carried for years all over the country and may at any time appear in many more places. To be ready to combat the pest on cotton, the Bureau is introducing natural enemies of the European corn borer in the south, to be bred on related native species. Why, then, all of the Bureau's claims about the extreme importance to secure imported varieties of dextrid, tachinid, ichneumon or other flies or wasps, or of other parasitic and predaceous insects, when, on the whole, the native kinds need merely to accustom themselves to this new breeding supply, similarly as foreign parasites breed on related species, and this they do when the new hosts have become abundant enough for a reasonable length of time, and, especially, when their usual hosts are temporarily scarce.

A good illustration of how natural enemies often fail is shown in my free Circular No. 187-A, referring to an outbreak of tent caterpillar in Oregon, which impeded train movements. Another case came recently to my notice. It has to do with an outbreak, worse than ever known before, of the pine tree lappet moth, covering thousands of acres along the border line of Germany and Poland. At this writing, since Chief Howard has remained deaf, dumb and blind relative to my original means of fighting such pests,

it is my intention to have the German Government test these means out on their own hook. I know their report will be favorable and you will then see other nations marvel at how we allow our officials to humbug us with our own good money.

Inversely, it looked early this spring as if the European earwigs would be much of pest about Portland and Seattle this summer. Both cities carried on municipal campaigns of spreading poisoned bran, and they attribute the comparatively slight damage by the earwigs during the past summer to effectiveness of their work. The fact is, earwigs are, at this writing, apparently considerably more numerous than they were a year ago. The results of an advertising campaign carried on by me this summer show that the people in the smaller towns infested, where no municipal campaigns of control were carried out, were also comparatively little troubled with the pest this summer. For my part I conclude that the pest is held in check by native parasites right now. The reasons for this conclusion are that for the past 9 months the rainfall in western Oregon and Washington was much below normal and the temperature was at the same time above normal. Such a condition is officially conceded to be favorable for the rapid development of tachinids, ichneumons and other parasitic and predaceous insects. Under favorable conditions a pair of parasitic flies can become the progenitor of many millions in a single season. On the other hand, these same parasitic insects are often nearly annihilated through having to serve as hosts for hyperparasites. It all shows that what we need most is really efficient, practicable artificial means of control. Our grains and fruits are kinds superior to the wild forms they were derived from through continued selection. And they are grown in vast numbers. Under primitive conditions such plants as clover, alfalfa, wheat, corn, apples, occur only scatteringly, hence their insect enemies do not find conditions favoring their rapid increase.

Under date of August 24, Mr. H. C. Atwell, superintendent of the earwig control work in Portland makes the following statement in the press: ". . . Quite a percentage . . . of re-infestation has occurred since our applications were made. This was due either to the fact that not all the insects were enticed to leave their hiding places until our poison material had lost its toxic effectiveness, or to the fact that second hatchings had not emerged at the time of our spreading. . . ."

If so, this then merely shows part of the short comings of that method of control. Part of the necessary conditions for any success under that system is to begin rather early, applications of bran bait after July 1st being admittedly of little value. Bait spread on in the early part of the night and not eaten during that night will not lose its toxic effectiveness for several days, but it will lose most of its attractiveness as a bait after being exposed to sun, wind and dew for a single day.

The reason why bran bait fails to exterminate is fully set forth on pages 2 and 3 of my free Circular No. 184-G. Read it if you are interested in earwig control. It is there shown at length that first of all earwigs always hunt for the most attractive food available. After beginning to feed above ground they find that they can satisfy their fondness for animal foods and sweets by feeding upon young plant lice, or at least, the honey dew these lice secrete. Thus the Bureau, in its work of investigating the food habits of the related Argentine ant, found that if the ants have access to honeydew, it becomes impossible to poison them with molasses. However, a way of making these molasses attractive under such conditions is shown in my Circular No. 168. Then, again, many plants, many roses for instance, exude sweetish secretions at their tips, buds or blooms. Further, there are the sexual organs of flowers. They are both highly nutritious and palatable. On grasses, for instance, they are quite inconspicuous, yet on a lot growing wild, earwigs will find an abundance of such food. Hence, having fed regularly on such food, and having an abundant supply of it, if bait is applied, this is liable to be merely sampled and soon rejected as inferior to the regular food supply.

In this connection, in the absence of any official cage tests with poisoned bait, it is proper to here make reference to a notice appearing in the issue of June 27 of the "Peninsula Herald" of Portland. It read: "One of our patrons has an earwig in a glass jar, which is being fed a daily diet of fresh earwig poison. At this writing, the third day, it seems to be as lively as ever and seems to be thriving on same." Also: a cow was accidentally permitted to eat a sackful of branbait and it was subsequently found she had eaten half the contents of a sack before falling over dead.

Thus the sum total of evidence available would indicate that the earwig is rather difficult to poison, even when not yet fully developed. As it develops fully, its resistance be-

comes greater. This raises the question, how then, can I consistently claim that the earwig can be easily controlled by poison at any time it is active and can, where desired, be actually exterminated? The answer is, I reject broadcasting, as officially advocated, altogether. I take advantage of the habit of the earwig to concentrate about specially attractive food supplies, a habit most pronounced during the mating season. I also use their desire to hide in attractive nearby places to lead them to highly nutritious and attractive well poisoned food, thus inducing them to fill up for once for good and become cured of further appetite. With concentration of the earwigs obtained, a little of the required bait goes a long way, none being wasted, nor is it exposed to sun, wind, rain or dew, neither is it accessible to birds, bees, cats or dogs. This bait, where necessary, as is often the case, especially inside when pantries containing meats and sweets are to be cleared, utilizes the desire of earwigs to feed on the choicest foods accessible. Baits of this kind are too expensive for broadcasting. Moreover, such bait would rapidly deteriorate when spread out.

Under my system of control, described in my Circulars No. 182 and 184, price 50 cents each, or the two for 75 cents, (discussed in detail in my free Circular No. 184-A), the use of broadcasted bait of any kind is completely rejected as possessing entirely too little value for the cost involved, even under city conditions proper, where a heavy outlay per acre can be more readily borne than elsewhere. The means I describe show you how to concentrate the earwigs and get rid of them by various easy means. One of these means shows you how to coat the tips of plants with poisoned sweets on a large scale and at very slight cost per acre. This method was originally evolved by me to make it possible to kill in a large way Mexican bean beetles, a problem Chief Howard and his experts failed to solve.

True in Farmers' Bulletin No. 1407 they claim they solved this problem. They show you there under Figure 10 a field, sprayed with magnesium arsenate, and growing, with part of the field unsprayed, and ruined. But this illustrates only their old fake, for the adults do not feed and oviposit to any extent on sprayed or dusted foliage. They simply fly to unsprayed foliage. Their second choice food plant is beggar-weed, which grows abundantly wild, hence with all fields sprayed they multiply there, to re-infest the fields as soon as new foliage has developed. Whereas my system of con-

trol coats the tips of the beans, both upper and lower side of foliage, and actually makes the beetles eat readily of the poisoned foliage. My system, further, concentrates the beetles by certain easy means and makes a small patch properly treated protect a large area. See my free Circular No. 171-A.

This method of coating the tips, however, is, in earwig control, intended to be used only, in a limited way, in connection with other, easier means and only where it is desired to clean out a bad infestation in the shortest possible time, and it is referred to here only to show that, if broadcasting of poison bait in a large way were necessary to control the earwigs I show you how to do it very much better and cheaper, since under this method the tips of the plants, where the earwigs usually feed, are poisoned, and poisoned without the use of expensive machinery and without any waste of material, as is incident to spraying and dusting. I also show you a way to utilize poultry to clean them out on a large scale, as on the farm and ranch. Much is said about tachinids and ichneumons controlling this pest in England. While there can be no doubt that they help to control the pests there, it is quite possible that poultry, and also wild bird life, has learned during generations back to hunt for the earwigs, while our poultry as yet need to be taught. This, my system, does in an easy and simple way. I also describe means to actually exterminate the pest where such is desired. My system enables you to get rid of earwigs easily, cheaply, safely, any time, anywhere, and under all conditions. This is a strong claim, but I could not for 4 years make Chief Howard do anything to contest this claim. The whole question has been for about a year called to the attention of Governor Pierce of Oregon with the view of having him take the matter up in a confidential way with the Oregon Agricultural Experiment Station. Insectaries have been built out of a donation by the city of Portland of several hundred dollars out of the budget sum previously allowed to the earwig control bureau. The legislature next January is expected to appropriate money for an extension of this work. This is all very well as far as it goes, but what we need most, and what costs nothing, is to have the Governors of States affected by serious insect troubles or threatened by them, as are the corn belt states threatened by the European corn borer, take steps to see that their State Delegation to Congress force President Coolidge to order a show-down.



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R27c
no. 188-A

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no. 188-A

The Maggot Problem

Fred Reinlein, 144 West Kilpatrick Street, Portland, Oregon

Circular No. 188-A

March 1, 1924

In speaking of maggots my aim is to not merely point out the difficulties of controlling such small larvae living within stems and fruits as the cabbage- onion or apple maggot, the adults of which are flies, and which are generally meant when the term of maggot is used, but I shall point out also that virtually the same difficulties are encountered with many other, often much larger larvae feeding within tissue, the adults of which are of other orders of insects than are the flies. Of these latter barkbeetles and wood-boring insects are examples. Thus the larvae of the potato tubermoth work either as leafminers or work within the tuber, working thus out of reach of means of attack.

Taking the term "maggot" in this broad sense, this includes the codlingmoth, the Oriental peach moth, various troublesome bud moths, all treeboring insects, the Angoumois grainmoth and all grainweevils and many forage crop pests. My Circular No. 188 gives specific means of controlling maggots, as the term is generally understood, and also gives illustrations of how maggots, taken in the broad sense of the term, can be controlled, by giving means to control bark and woodboring insects, for instance the leopardmoth, the locust borer, the apple- and peach tree borer and coniferous barkbeetles.

The means of maggot control, as given in my Circular No 188, are not claimed to be adapted, without proper modification and further development, to the control of the boll-weevil, the European cornborer, all grainweevils, the Angoumois grainmoth and many others, all of which are, as larvae, maggots, when that term is taken in the broad sense. Spe-

cific means for these and others are worked out in other circulars, for the bollweevil in Circular No. 183, grain pests in 176, forage crop pests in 178, the European cornborer in 172, the potato tubermoth in 160 and the European pine shoot moth in 161. Of insects, not classed as maggots, and which are discussed with proper means of control, there is the Argentine ant in No. 168, the elm leaf beetle in 173 and the May beetles in 180, besides a number of others for which advertising circulars have been issued.

Very little in the way of satisfactory means of controlling maggots, miners and borers has been officially evolved. Realizing that the correct solution of the problem rests in evolving satisfactory means of handling the adults, after much study I published in 1918 my Circular No. 153, dealing with the control of cucurbit insects and fruitflies, especially with the Mediterranean fruitfly and the melonfly of Hawaii. I showed there that the official means relied upon, which consist mainly in the collection and destruction of infested fruit and the spraying of the plants, are not practicable means of control, and described means that dispose of the adults at slight cost. These means were in subsequent circulars shown to be adaptable, with suitable modifications, to a wide range of insects.

This Circular, No. 188-A, is sent out with a liberal supply of other circulars dealing with the need of better means of insect control than now officially available. For this reason it mainly confines itself to telling you where you can find described satisfactory means of maggot control.

The price of my Circular No. 188 is 50 cents. If you do not see what you want, ask for it.

The General Insect Control Problem

Fred Reinlein, 144 W. Kilpatrick St., Portland, Ore.

Circular No. 191-A

March 31, 1925



MOST of us love to point to the great progress we make in a material and intellectual way. This is well enough if we do not forget to also take stock of how we progress or regress in things spiritual. But if improvements in means of insect control as endorsed by the U. S. Bureau of Entomology have kept pace with progress in other lines, I, for one, would like to be shown.

To illustrate: The Japanese beetle, after having been discovered in small numbers in 1916 at a point about 9 miles northeast of Camden, N. J., has now spread over about 4000 square miles and covers now practically all of the populous districts about Philadelphia and Camden. That means that the strict quarantine restrictions, which made possible the restriction to a comparatively slight spread in years past, cannot now be any longer effectively carried out. The Federal Horticultural Board, in its report for 1924, p. 6, admits that but for quarantine restrictions in the past this pest would now be widely distributed throughout the United States. The Board also admits that there is an unavoidable spread of the beetle of 5 to 10 miles annually, due to the flight of the beetle. As nothing of real value in the way of control has been officially worked out, and the Bureau has deliberately and persistently ignored means of control evolved by me, means that render control extremely easy and cheap, the Bureau of Entomology, instead of checking the pest, is really protecting it, since, granted the means of control I have worked out are as easy and cheap as I claim, they make it possible to minimize the numbers of the pest, reduce the tendency to spread, due to the few survivors finding abundant choice food close by, and cheapness and ease of the method making possible attack as soon as any beetles are found anywhere to have gotten a foothold, whereas the Bureau, in remaining passive—neither endorsing nor condemning my system—does its best to prevent getting correct means of control in action.

I am in no way mis-stating anything, either here or in any of my publications. Since sooner or later a show-down must be forced. I fully realize that I have the best chance of making headway quickest by having every statement absolutely accurate. For instance I said just now the Bureau has worked out nothing of real value in the way of controlling this insect, nothing beyond working out the life history and food-habits of the insect and making certain attempts at control, but I do claim they have absolutely failed to work out a satisfactory method of control.

This you can readily see to be true, when you have acquainted yourself sufficiently with the situation to know that any repellent poison used admittedly simply drives the beetles to unpoisoned vegetation, thus incidentally, to that extent, accelerating natural spread by flight. Also, the non-repellent poison the Bureau is said to have evolved cannot help matters, since the beetles then attack sprayed vegetation same as if it were not sprayed. As then the choicest foods, corn ears, apples, plums, peaches, flowers, have nothing about them to repel the beetles, they will concentrate on these choicest foods, and thus attack mainly the fruits, and as they there do a minimum of surface feeding, the little poison possibly eaten in burrowing into the pulp cannot harm them, resistant to poison as they are.

The only other official means of control proposed to be considered then is the use of natural enemies. But all that is and can be claimed for their use is that they "maintain the balance in nature." They cannot exist without their hosts. And as long as any Japanese beetles exist, they will select as far as possible the choicest, hence economically most valuable, food. Since the female lays nearly one hundred eggs, if the insect enemies and other adverse factors destroy 90 per cent, there would yet be urgent need for artificial control.

Thus it will be seen that I was telling only the truth when I said the Bureau has evolved nothing of real value in the way of controlling this pest. But the world does move, and as the Bureau cannot be expected to possess all of the brains, why should it be strange that some one outside of

this organization should be able to see vulnerable points in their life history and manner of feeding not seen by the Bureau, and utilize them in building up a successful system of control? And, moreover, these means were mostly shown to the Bureau as long as 4 years ago, and the Bureau was all along wanted to criticize them. Nothing was done, this in spite of the fact that all along the Presidents, Secretaries of Agriculture, Members of Congress and Governors of certain States were shown the need of a show-down. That means, you pay your money and take your choice.

Japaneses beetles are very easily controlled, and can be poisoned in masses by concentrating them to poisoned food rendered more attractive than any other they have access to. This can be very easily done, and is all explained in my Circular No. 185. And the problem of control is discussed in my free Circulars No. 185-A-B-C-D-E. Similarly, the control of other important insects is taken up in other circulars, the problem of control being in a number of cases discussed in one or more contingent circulars dealing with a specific problem as, for instance, the Japaneses beetle problem. These circulars incidentally discuss a radically new method of killing insects and fungi at the same time in a large way at far less cost than any other method known. In the past it seemed to be easiest to force a show-down by concentrating on insects just now attracting most the attention of the public in various parts of the country.

In consequence the Japanese beetle, the Mexican bean beetle and the earwig were chosen as specially suitable for the purpose, the respective circulars were advertised in localities where these insects are pests, and copies sold, thus getting up lists of people that had used my new methods and to which Governors of the state they lived in could be referred, if these had, in the absence of action on the part of President Coolidge, any desire to serve the interests of their commonwealth. Since they did nothing, it became apparent that it was best to add to the list of previously published circulars one that would give a synopsis of the means of control evolved, as used for general insect control, hence Circular No. 191, 10 pages, has now been added, to specially advertise which this Circular No. 191-A has been written.

From the nature of the case special circulars such as No. 185 elaborate on the special means necessary in the case of that particular insect, whereas No. 191 gives briefly information which in cases of moderate attack would meet the needs fairly well not only of controlling the Japanese beetle for instance, but practically of all other insects affecting plants you are likely to be bothered with. In most cases the best thing to do is to buy Circular No. 191, the price of which, like any other circular you might select, is 50 cents, and then, after examining contents and finding you need, or can use to advantage, special information on the control of certain pests, to buy the respective circular or circulars dealing with them at 25 cents each.

Of special Circulars, No. 164, which comes supplemented by No.'s 165, 166, 171, deals with the control of the Mexican bean beetle. It shows how the work of control can be made very easy by correct use of poison and proper concentration. No. 167 deals with the control of the pink bollworm, a pest that has been kept sharply in check at great cost, but which can hardly be kept out in the long run. Why? Because, in the first place, flood water from infested territory in Mexico will carry infested bolls down the Rio Grande to the Gulf, and the Gulf stream will wash them northwards, some to settle ashore. Then, the adults are capable of long distance flight, live an average of about 17 days, fly with the wind and, as the prevailing wind is northeastwards, are liable to be blown northeast. They have a spiraled tongue, showing they feed on the nectar of cotton blooms and probably of blooms of related species, thus during a period of strong wind from the southwest are liable to be blown far north into cotton territory. No. 168 deals with the control of the Argentine ant. Gives essentially distinct and valuable information in showing an effective method of poisoning for use when honey dew exuded by aphids and coccids is available. No. 172 deals with the control of the European corn borer. No. 173, the elm leaf beetle, gives much information about general shade and timber tree insect control. No. 176—grain pests, especially as encountered in the southern half of the country. Considers in detail the control of the "black weevil" of the southern states (*Calandra* (*Sitophilus*))

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oryza) and of the Angoumois grain moth. Gives the only correct method of bean and pea weevil control. No. 178— forage crop pests, especially the alfalfa weevil and grass hoppers. Shows a way to keep the hoppers from further hopping soon after hatched. Gives a detailed account of the use of light in various forms in combination with other means of control, practicable in the control of most insects flying by night and not naturally adverse to approaching light, as a small percentage are. Shows a method of trapping insects alive and shows a remarkable record of attraction of grasshoppers to electric lights miles away from their feeding grounds. No. 180 deals chiefly with May beetle control. The methods described control with ease a related pest, often highly destructive to corn and cane, the rough-necked cornstalk beetle. No. 181 discusses the control of the green June beetle, a day flying scarabaeid beetle, same as is the Japanese beetle, and also the control by way of illustration, of the European pineshoot moth and the oriental peach moth, two very important pests, and beyond any practical control by the means the Bureau advises you to use. Gives correct method of controlling the codling moth. No. 182 deals exclusively and exhaustively with the control of the earwig, a pest in certain section of Oregon, Washington and Rhode Island. No. 183 gives you a system of controlling the cotton boll weevil, enabling you to control this pest throughout the season, under all conditions, with the greatest ease. Cotton growers should buy both No. 183 and 191, since the latter gives much detailed information about practical means of controlling cotton bugs, cotton lice, red spider. Nothing really practical has been officially evolved. No. 184 discusses earwig control in connection with such other insects they are likely to be associated with, especially orchard insects, the hop flea beetle and snails. No. 185 gives the correct control of the Japanese beetle. Shows you how to kill them in masses at slight cost. No. 187 deals chiefly with the control of orchard, shade and timber tree defoliators, for instance the tent caterpillar, the gipsy moth, satin moth, brown tail moth. Gives means to control them in a large way with ease. Shows the use of caged gipsy moth females, bred from collected pupae, for whole sale destruction of the pest, and gives means of controlling migrating caterpillars. No. 188 deals with maggot control, including fruit flies, the

codling moth and borers of all kinds, as the leopard moth, nut weevils, bark beetles. No. 189 briefly reviews timber insect control and describes practicable means of controlling sucking insects on timber trees as also fungus diseases. No. 190 shows the true nature and proper means of control of the trouble known as the "white pine blister rust." No. 191 deals with general insect control, but goes well into the control of bugs and sucking insects generally as of the harlequin cabbage bug, the chinch bug, the Mexican conchuela, the grain bug, lice, scales, flea beetles, the corn earworm, bill bugs, the roughnecked cornstalk beetle and shows a method of trapping insects that fly by night, but are adverse to light. If you do not see what you want, write.

These new methods of control involve the use of principles, as for instance the use of sap of trees, that have mostly never been used at all by the Bureau or, when used, were used in such a way, and unsupported by other necessary means to make them effective, that the system of insect and fungus control evolved by me bears the same relationship to present official methods that modern means of transportation bear towards the oxcart.

As soon as the present Secretary of Agriculture was selected for that office a brother of his, who is Director of the Agricultural Experiment Station at Corvallis, Ore., and who, because of holding that position, had of necessity become acquainted with some of my work, especially as it affected the control of the earwig in Oregon, was thoroughly posted in regard to all of my publications from No. 164 up, so that he might be of assistance to his brother, if he so saw fit. There was no reply.

However, this does not really matter. Nor does it matter that President Coolidge has done nothing to force the Chief of the Bureau out of his rat hole and make him meet the issues. I calculate all this will take care of itself in due time. What really matters is that You and I each attend to their respective business. As the case stands, if you buy copies of the circulars in question you have an advantage in control of insects and fungi while others have to shift for themselves the best they may. This is not the ideal way to do it, but with the unfair passive resistance by Chief Howard permitted to persist, there is at present no other way left.



CIRCULAR No. 193-E

SATIN MOTHS

were first discovered in the United States in 1920 near Boston, Mass. Yet they were found to be scattered already last year over most of the western part of the State of Washington, largely due to the tendency of the moths to fly along roads with the automobile lights. At this rate, then, extension of infestation will be rapid, and quarantine, as now in effect, will be of little practical use.

The possibilities for damage by this insect, and also of the more widely known related tent caterpillar, a native insect, subject to attack by many native natural enemies, are not generally realized.

The satin moth has normally willows and poplars for food plants. Now, willows and poplars will grow on lands that are too poor to support better kinds of trees. They grow for instance in masses on the large sandy areas along rivers, areas that at times are covered by flood waters. They are provided by nature to act as sandbinders, to prevent the filling up of the riverbeds, and are to that extent a necessity.

It is obvious that willows and poplars thus growing wild can not only not at all readily be sprayed—the official main reliance in the way of control—but the cost compared with the commercial value of the trees would, because of the difficulty of gaining access, be unbearable. Thus, with the official means of control confined, on planted trees, to spraying, to the crushing of larvae and

pupae, and the creosoting of egg clusters, and these means on willows and poplars growing wild not feasible of application, it becomes evident that these masses of willows and poplars growing wild offer to the insect an unlimited opportunity to multiply. The real danger from this insect is this: After these wild willows and poplars have become heavily infested, this means that willows and poplars growing for ornament will also have become more or less regularly heavily infested. Unless infestation of these planted trees is prevented by any of the official means of control—or infestation is combated by the process of creosoting egg clusters, or spraying the trees to destroy the partly grown larvae, the full grown larvae being about 2 inches long and practically immune to poison, vast numbers of caterpillars will develop on these willows and poplars and will strip these trees of all foliage long before they are full grown, with the result that then they will attack and complete their development on most any kind of deciduous tree.

It is the same with the tent caterpillar, only this insect has a wider range of food plants while young, occurring thus comparatively more scatteringly. To illustrate: The related gypsy moth cannot, upon hatching, maintain life, if confined in its food supply to conifers. But if the newly hatched larvae are supplied long enough with suitable food as

furnished by most deciduous trees, oak for instance, to complete the first two instars, the insect, then only about one-tenth by weight of the full grown larvae, can then acquire the remaining nine-tenths of the growth on conifers, with the result, that in New England more than enough larvae develop on deciduous trees to enable these partly grown larvae after more or less defoliating these trees to attack stands of conifers, among which these deciduous trees are located, and kill vast stretches of coniferous trees.

Then, what can be done in the way of satin moth control? Nothing of consequence can be done in a large way with the means officially recommended for this and various other moths of similar life history, as the gypsy moth, the browntail moth, the leopard moth and the tent caterpillar moth. These and numerous other insects find the bulk of their breeding ground not on the comparatively few planted trees, but on trees growing in woodlands. If a method of control cannot be devised for them there, the heavy infestation occurring there will always be a menace to fruit and shade trees, and if a satisfactory method can be devised, fruit and shade trees will be but comparatively little attacked.

A satisfactory method of control does exist. It consists in concentrating and destroying the moths, and was evolved and described by me during the past 23 years, and described more recently in my Circular No. 187. If interested, send for free Circular No. 187-A.

This system of controlling orchard, ornamental and forest tree defoliators, like all my other improved means of insect control evolved and

described during the past 28 years, was submitted to U. S. Entomologist Howard for action. No action of consequence was ever taken, except a recent action to steal part of the original means for describing a method of Japanese beetle control, made by Chief Howard in his report for 1925, and what he is evidently after is to steal, if possible, all the rest, a matter to be adjusted in due course of time, and discussed in my free Circulars No. 193 A, B, C and D.

Chief Howard does not want such action taken, as, under the law, which requires him to promote entomological knowledge in its broadest sense, he is required to take. He has no use for new and improved means of insect control, no matter how good, if they do not emanate from his office, unless he can plagiarize them. He is a scoundrel.

For proof I will go here into sufficient detail to enable you to judge as to who holds the trumps in this game.

Since, as the case stands, I am expected to point out easy means of controlling the satin moth and more or less related species, taken as timber pests, I will begin by first of all referring to a method of mass control of the browntail moth of New England, described in my Circular No. 160. Both sexes of this insect are very strong flyers and are very readily attracted to brilliant lights, so much so that eggs are more often than not deposited within a moderate range of such lights. I showed, that if a practicable way could be found to destroy these moths when swarming about these lights, this would so reduce the numbers of the pest at large as to render it practically harmless. For a means of con-

trol I showed that it would be feasible to hoist onto these lights, electric street lamps for instance, invitingly smelling poisoned sweets, at very slight cost, and thus solve the problem.

In the case of the satin moth both sexes fly readily and both sexes are attracted to brilliant light. It is feasible, therefore, to dispose of the bulk of the satin moths that swarm about brilliant lights by giving them there ready access to suitably displayed poisoned sweets. Details are given in my Circular No. 187. This method is applicable to practically all insects swarming about lights, as for instance cutworm and other noctuid moth, and also May beetles, the parents of white grubs. I showed also in my Circular No. 160, that in the case of an insect where only the male flies, the gypsy moth for instance, it is possible to destroy the males in large numbers by purposely breeding virgin females, which, in the case of the gypsy moth for instance, can usually be very cheaply done, and exposing these females suitably caged, near these poisoned sweets.

To dispose of the satin moth and other injurious insects attracted to lights by the use of these lights does not, however, usually satisfactorily solve the problem of controlling these insects looked at as timberpests, many of which will be many miles away from brilliant lights, or lights of any kind.

Thus, this being quite another problem, we have to use quite different means of accomplishing our end. Nothing along this line has been worked out and published by the U. S. Bureau of Entomology. These trees, growing wild, we can, and, of necessity, have to use means of con-

trol that would not be feasible, to the same extent at least, on ornamental willows and poplars, or other trees.

If you cut a willow or poplar, big or small, or any other tree, down during June or July, you will notice two main effects. First, the drying top will give off a strong smell peculiar to that particular kind of tree, and the new cut will give off freely of sap. This smell and sap are attractive to many of the insects that have that particular kind of tree for a host. This smell and sap, therefore, in themselves, offer a chance for concentrating certain injurious insects to that particular point. Now, if the sap be artificially so improved as to accentuate its natural effect, this correspondingly increases the chance of concentrating and destroying the insects. If you will paint the new cut with molasses, the sap is apt to flow so copiously as to wash the molasses off, and, this mixture running down the stump, is highly attractive to many moths, beetles and other classes of insects. And, of course, if this molasses is poisoned, this poisons the insects thus concentrated. On ornamental trees substantially the same effect is secured, if a branch or some small twigs are cut off and allowed to dry. If the cuts are purposely made abnormally close, this will cause the exudation of enough sap to accomplish our end. Or, if mostly big trees are to be dealt with, you may cut off a slap of bark just deep enough to cut down and through the cambium, stopping as you reach the sap wood. Such a slab cut, if suitable painted, will be a very cheap means of attracting and killing many insects. This method is applicable



to a great many insects, bark beetles infesting conifers, for instance, as described in my Circular No. 188. Send for free Circular No. 188-A.

The U. S. Department of Agriculture is constantly shouting itself hoarse telling the people our forests need better care, but when you ask Secretary Jardine to bump Chief Howard's scientific nose on the evidence, and have him spit out what he has to say, good or bad, he is not on the job.

The improved methods of control thus far pointed out represent a great step forward in insect control, especially as they affect orchard, ornamental and timber trees, and are more than sufficient to show that Chief Howard is a scoundrel in deliberately impeding progress by failing to give credit to me for evolving them, and by failing to endorse them, and instead telling members of Congress, as for instance only recently to Senator E. I. Edwards of New Jersey, that the improvements I have made possess only a most restricted value.

But there are numerous other claimed improvements of mine on which Chief Howard was wanted to talk for many years past. Thus, to come back to timber insect control, taking for illustration an insect like the satin moth, or the native tent caterpillar, the adults of which are readily attracted to light, I showed we might not only use the means already described, but, where convenient, as where there is some kind of dwelling in the woods, especially if located on some eminence, increase concentration by displaying, along with drying tops and attractive sweets, a light, especially when the insects are very abundant. In the absence of brilliant lights, merely displaying a lantern, supplied with enough oil to burn till about mid-

night, will give the desired attraction. On the other hand I showed, that, when you have to do with an adult that is adverse to light, you can increase destruction, and incidentally get a record of what insects are present, by using no light, but bringing into play sticky substances. Thus a shallow flat pan of good size might be coated with the mixture that is used to make sticky fly paper, consisting of rosin and castor oil, or sticky fly paper might be suitably placed, attractive, invitingly smelling poisoned bait being placed in the center of the paper or papers. A good many of the insects thus attracted will get stuck. If interested in these problems send for free literature, especially Circular No. 178-A. Circular No. 178 deals with forage crop insect control, more particularly with the control of the alfalfa weevil, and describes on page 4 incidentally a method of using a gasoline torch at night as a trap, by the use of which the following killing agents are employed all at the same time: A red hot burner, surrounded by a chamber that confines most of the light within, but permits admission of insects to the light from the darkness without, attracted by the sweetness of a smell generated by the heat of the torch through acting on attractive liquid bait, to be reached only by entering the chamber, where upon entering the insects, because of the sudden change from darkness to light, are liable to bump against the red hot burner, become temporarily stunned and drop into the trap containing the bait. This method very often gives results where other, more simple means prove inadequate.

For the control of sucking insects such as bugs, lice and scales, and also for the control of biting insects that are not readily amenable to the use

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of poison as generally used, I had described as far back as 1898 a method of using heat generated by a gasoline torch. Chief Howard plagiarized as far back as 20 years ago this method to a certain extent. However, he would never admit that, properly developed, this method is far the best means to control sucking insects on trees. Thus, western Washington is now becoming infested with the lecanium scale, which, according to Prof. Trevor Kincaid, of the University of Washington "is more destructive of plants and trees than is the earwig." Prof. Kincaid saying, that if the insect spreads to the eastern part of the state almost certain disaster will befall the fruit industry. Well, with the means of rapid transit we have nowadays, there seems to be plenty of chance for such spread. This insect, as al scales, can be easily controlled in a large way by my method, and evidently, an official showdown is needed. Send for free Circular No. 191-A.

One of the more important improvements of mine on which Chief Howard refused to talk is a new, easy method of poisoning bugs on a large scale at slight cost, something in the past generally considered to be impossible of accomplishment. This method is of wide practical application, including many biting insects not readily amenable to the use of poison as generally used. Thus, for instance, cotton is now in certain sections being severely attacked in great numbers by a minute bug, known as the cotton flea. My Circular No. 192 describes proper means of control. Send for free Circular No. 192-A.

I now will show that Chief Howard is not only a scoundrel but also a

deliberate thief. In his report for 1925 he plagiarizes my system of baiting as described in my Circular No. 161 for the control of the Japanese beetle as far back as 1921. True, he tells Senator Edwards, through Assistant Secretary Dunlap, he made this discovery independently of me, but any fool can make such a discovery after somebody else has shown it before. In any case, even if I could not prove priority by a margin of four years, I am still ahead, because my method is far the better and cheaper, for not only do I describe the source and the use of what Chief Howard chooses to call geraniol, but showed how this work can be done simpler by not only showing the best and simplest source of geraniol, but also showed the advantage of using attractive smells, such as can be secured at moderate cost by the use of macerated peppermint tops and flowers, rose blooms for instance, but also showed the feasibility of the use of sap and bait combined, specifically pointed out in my Circular No. 193, and described in a general way as far back as my Circular No. 160, issued in 1920. I also showed the use of adults, separated as to sexes, to increase concentration. I also showed a modification of this method for use on corn and other crops.

Earwigs are becoming a serious problem in some sections of Washington and Oregon. Chief Howard wanted in 1921 Prof. Kincaid to test out, and report on, my means of earwig control as then described. Mr. Kincaid refused. Send for free Circular No. 182-C. However, in reality, the delegations to Congress from these two states are the ones most to blame for the practically unhindered development of the pest. I

had described very good means of controlling this pest as far back as October, 1920, and the delegations were wanted to force a show-down in Washington. Nothing was done, with the result that, under the system of getting in the spring more or less of a dose of broadcasted bait, as officially advocated, earwigs have flourished like the proverbial bay tree. This system, at \$10 an acre, applied to Seattle and King county, would cost over 3 million dollars.

Moral: A good licking to a stamp, and reference to this advertisement, will enable you to tell your Congressman and Senators, all of whom have been posted, that you want them to ask for a show-down. If interested in earwig control send for free Circular No. 184-G.

Just why there is such a disinclination on the part of congressmen to ask for a show-down is not quite clear. True, they have proved to be the easiest of easy marks when Chief Howard handed them a bundle of lies without proof. These congressmen are all anxious to tumble over one another to introduce bills, bills, bills, intended to benefit their constituents, but when I ask them for a show-down on the earwig issue, telling them I am willing to take all

chances of being knocked high enough to come down in the next county, they fight shy. All efforts in the past to have U. S. Representative J. F. Miller work for a show-down proved futile. In consequence, especially as the earwig problem is becoming yearly more acute in Portland, I asked repeatedly Representative M. E. Crumpacker of Portland, upon beginning his actual service last December to ask for a show-down relative to my system of earwig control, but he ignored all these requests; yet he introduced several bills, all payable by other people's money, and now wants to be re-elected, claiming to have made good.

With the earwig trouble most severe within the city limits of Seattle and Portland, the city authorities ought to take the lead in making such a request upon their congressmen. There is not a congressional district in the land that would not be benefitted by a show-down such as is aimed at and the only thing it will be hard on will be Chief Howard's stinky hide.

**FRED REINLEIN,
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Portland, Ore.**

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DR. L. O. HOWARD

Chief of the U. S. Bureau of Entomology,

with the Japanese Beetle problem becoming yearly more acute, and President Coolidge and Secretary of Agriculture Jardine having for years failed to order a show-down, is herewith wanted, in the interest of all concerned, so answer the following questions:

1. Did not, in September, 1923, U. S. Representative F. F. Patterson, Jr., submit to you through the Secretary of Agriculture, a copy of my Circular No. 185 for criticism? (Correct answer: Records show he did.)

2. The Circular No. 185, containing as it did a description of my system of Japanese beetle control, did the reply of the Secretary of Agriculture to Mr. Patterson, emanating as it did from you, make any comment as requested on this system of Japanese beetle control? (No reference at all was made to any of my work. A detailed account is given in my free Circular No. 185-B.)

3. Do not the essential principles of my system of control consist, first, in the proper use of specially attractive poisoned food, and, second, in the use of caged adults, separated as to sexes, this use of caged adults being for the purpose of intensifying concentration, and make possible maximum destruction for a given outlay? (Copyright records show they do.)

4. And were not these principles described by me as far back as 1921 in my Circular No. 161? (Copyright records show they were.)

5. In your report for 1925 you speak of the proper use of what you choose to call geraniol as practically representing the key to successful control of the Japanese beetle. You state there that geraniol is a name given to a product containing attractive oils secured from preferred food plants of the beetle. Do not these

oils occur, as a rule, more freely in certain parts of the plants, as in the blooms, fruits and tender tips? (It is well known they do.)

6. Have not the various official publications, especially Department Bulletin No. 1154, made special mention of certain fruits as being very pronouncedly attractive to the beetles, for instance early sweet apples, especially if wormy or affected by disease, and peaches affected with brown rot, and is it then not manifest that such fruits are among the very best, if they are not actually the best, sources of geraniol? (The proof of the pudding is in the eating. The beetles feed there by preference.)

7. Did not my Circular No. 161, and more specifically my Circular No. 185, point out that such fruits as mentioned, or fruits ripening prematurely because of attack by bacterial disease, as early peaches maturing abnormally early on a branch showing the presence of the disease known as peach yellows, can be used to prepare the all around most practicable and attractive bait, simply by maceration, addition of sweets, fermentation and proper display, with poison added? (Records show they did.)

8. Then this method of attracting and destroying beetles having been described long before you ever started to talk about geraniol, are you not then simply dishing up, under the pretense of having evolved something new, the method originally described by me? (Spit it out, Dr. Howard.)

9. Are you not, even as late as in

your report for 1925, before you finally recommend the use of bait as recommended by me for 5 years past, talking about the need of a material which would be decidedly attractive to the beetles and which could be combined with "a poison spray in such a manner that the beetles would feed readily on the poisoned foliage," to be killed subsequently by a contact spray? (Dr. Howard does there say so.)

10. Then what for are you talking about such a round-about, slow, expensive and uncertain method as of killing beetles on foliage, when much better and cheaper results can be secured by attracting them to bait, even if used in the much more expensive way you propose to use bait? (After having for years recommended the use of unattractive and actually repellent sprays, Chief Howard does not feel safe in pronouncing sprays as being quite unnecessary when bait can be used, thus showing that he not even then realized the full value of using proper baits properly.)

11. It being your duty to promote entomological knowledge in its broadest sense, have you then, in dodging the issue in the past, not been deliberately working against sound progress, simply with a view to, if possible, finally claim for yourself or your assistants to be the originators of the use of bait and of other means necessary for most efficient Japanese Beetle control? (Answer:)

12. And is not a man that follows such a course everywhere called a scoundrel? (.....)

13. Speaking about materials attractive to the beetles, did not my Circular No. 161 point out that in addition to suitable macerated, sweetened and fermented fruits, that had ripened prematurely, hence possessed little or no commercial value as human food, attraction might be cheap-

ly increased by testing out the use of such substances as macerated peppermint tops, or rose blooms, or any similar promising materials obtainable easily in a given case? (It did.)

14. Did I not in my Circular No. 160 describe for the control of insects having feeding habits more or less like the Japanese beetle a method of control by the judicious use of sap of trees by doing more or less close cutting on trees to be protected, including timber, shade and orchard trees, and painting these cuts with poisoned sweets, attracting these insects to these points and causing their death? (Records show I did.)

15. And did not my Circular No. 193 specifically point this method out in reference to Japanese beetle control? (It did.)

16. Did I not in my Circular No. 161 and 185 also described a modification of the use of baits, as applied to corn, especially through the use of trap patches of corn or, more effectively, of sweet corn? (I did.)

17. Did I not there also show, that concentration and destruction, for large scale work, could be carried out cheapest by properly using adults separated as to sexes? (I did.)

18. Since you have not yet attempted to plagiarize all these additional means, necessary to make a complete success of control, is not then what you really dish up yet far from being the best system of control that can be devised? (President Coolidge and Secretary Jardine manifestly are bound to make Chief Howard answer, or, failing in this, every Congressman in the land should insist on a show-down, there being numerous other matters just as important waiting to be attended to. For details send for free literature.)

FRED REINLEIN

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CIRCULAR No. 193-J

JAPANESE BEETLES

have now shown themselves as sufficiently destructive to the people of Camden to make them realize what is in store for them in years to come in the way of annoyance and loss, if these beetles are not controlled by very much more efficient means than those officially recommended. Under the circumstances it is natural that the city, town and village authorities within the area affected, should, with a view to reduce expense to themselves

and their fellow citizens, be willing to look into anything reasonably promising along this line. For this reason the following circular letter has been addressed to the Hon. Mayor and City Commissioners of Camden for their consideration, and same is here incorporated in an advertisement, which, in circular form, is to be sent out with other information to the guiding bodies of other communities affected.

To the Hon. Mayor and City Commissioners of Camden, N. J.

Gentlemen:

The spread of the Japanese beetle was officially given previous to this year's dispersion as being over 6000 square miles. Present evidence indicates that this estimate was considerably too low, and that the pest is now spread over about 10,000 square miles, the pest having reached some of the populous territory about New York City. You know that certain funds have been specifically set aside to enable the U. S. Entomologist to have tested out anything at all promising in the way of control. Now, with the beetle having made such headway as it did with all the monies spent on repression, it is manifest that the means of control now officially recommended are far from being as effective as is

desired, that, therefore, anything reasonably promising should have the fullest investigation.

In order that you and others of your community may have a fair chance to see just what I have to offer along this line, I enclose a copy of my Circular No. 193, copies of which are ordinarily not sent out free. This circular was chiefly written to enable members of Congress to briefly acquaint themselves with various essentially new means of controlling certain important insects now attracting attention, the matter of controlling cotton insects and controlling the Japanese beetle being gone into by way of illustration sufficiently thorough to show the need of official action.

We love to think of our republican-

democratic form of government as an institution, where in a case like this all we have to do is to ask the U. S. Department of Agriculture to tell us what is what, or, at most, ask our representative to Congress to make such a request for us, and action comes about as easy as rolling off a log.

Such, however, is far from being the case in the matter in question. I had described, what, the future will show, represents the correct method of Japanese beetle control, as early as in February, 1921, and the U. S. Entomologist, Dr. L. O. Howard, was ever since wanted to test this system fully out, and then either endorse it, or else show why it should not be endorsed, but beyond handing out evasive answers and outright bundle of lies to Congressman Patterson, Senator Edwards, and other members of Congress he never did anything of this kind.

To show that my system deserves the fullest investigation I will state here that it rests upon judiciously utilizing the tendency of the Japanese beetles to concentrate largely upon the most attractive food supply within reach. Under my system what is the most attractive natural food supply is so improved as to be made still more attractive. Thus certain individual early apples and peaches, for instance apples that are wormy, or peaches that are wormy, or are affected by brown rot, or both, fruits that have little or no commercial value and that are earlier in maturity and more attractive to the beetles than is sound fruit, are so manipulated by a very easy process as to be rendered still more attractive to the beetles. Now, manifestly, this is a promising idea. But suppose it is not, well, why does not Chief Howard come out and say so? For further details see my Circu-

lar No. 193. It is there shown that Chief Howard has been plagiarizing this system in his report for 1925. For further details on this point see my Circulars No. 193 F and I and other matter enclosed.

Under my system the beetles are constantly concentrated during the whole season to certain specially attractive foods, for instance silking corn, and are continuously there destroyed by a very easy and efficient process, which, for really large scale work, also utilizes the attraction one sex has upon the other. This means decrease in their natural flying radius, since the most attractive food thus displayed is displayed usually in the center of a given infested area. Thus, with the beetles constantly kept killed off vegetation is but little injured, and the comparatively few newly arriving beetles have always plenty of highly attractive food close at hand, hence spread far less than they do under the official system, where the most attractive foods, as for instance early peaches, are rendered more or less unattractive by repellent sprays, and other unsprayed food is rendered unattractive because of the feeding of the great number of beetles. Had my system been promptly adopted, natural spread by flight would have been very greatly lessened, and wherever there were any beetles they could have been promptly decimated, and moreover, under my system numerous other important insects could have been controlled at the same time. Under my system control is so easy and cheap, and is carried on in connection with the control of other insects, there is no need to fear the insect, and quarantine is not necessary.

This is a strong claim to make, but if not exactly true, let Chief Howard

show us wherein I am stretching the truth. Yet Chief Howard, the scoundrel, told Senator Edwards this and other means of control I worked out have only a most restricted value, but he refused, as always, to come to details. What he wants to do is to try to successfully claim credit for having worked out this system. U. S. Department of Agriculture Circular No. 363 treating on the Japanese beetle, recently issued, however, makes no reference to my system, or the principle underlying it, showing that it is foreign to them.

In view of the failure of the members of Congress from the infested territory to properly work for a showdown I decided to prosecute more vigorously a matter of interest to the people of Portland and Seattle and other towns in Oregon and Washington, namely the infestation there by the European earwig. This pest is closely related to the cockroach, and is becoming yearly more and more a nuisance in spite of Portland and Seattle having spent of late years about \$200,000 a year each in an attempt at control by following the officially recommended method of using broadcasted bait. King County, Washington, with Seattle as county seat, proposes to enforce the use of this method for 1927, and will charge, if the work is not done by the owner, \$4.00 per lot. This means about \$5500 per square mile or \$12 000,000 for the 2111 square miles of King County. Such a taxation is highly onerous on city property, but cannot be borne at all on rural property. At the above rate the cost to the citizens of Seattle is about \$375,000. Now suppose someone would show a way to do this work for half the money. Would it not then be worth while for the citizens of Seat-

tle to force Chief Howard to a showdown in this matter? Well, if my system of control and extermination is adopted, the work can be done for about the hundredth part of this cost, and it will then be done very much better at that.

As far back as in October, 1920, I showed much better means than those officially advocated, including a method of effective control by the use of poultry. Chief Howard who wants to be taken for an entomologist, and who for years told members of Congress I am no entomologist, and who told them that the improvements in means of insect control I made have only a very limited value, so limited, that, in practice, he does not find it worth while to discuss them, was wanted as early as that to show in this matter, that he is an entomologist, by at least expressing an opinion as to the merits and demerits of the case, but, same as in numerous other matters, the control of the bollweevil, the cottonflea, the European cornborer, the Mexican bean beetle, the gypsy moth and the Oriental peachmoth for instance, he did nothing whatever of this kind. Instead he suggests that I have this work done by Prof. Trevor Kincaid, of the University of Washington at Seattle. I made the attempt. Prof. Kincaid declined with considerable acidity. For details see my free Circular No. 182-C. As to the Oregon Agricultural College people at Corvallis, Ore., they were for over 5 years wanted to criticize these means, but they declined to do so.

Since the state experiment station people are, in the last analysis, federal officials, since they are not appointed by the governors of the states, but by the United States Department of Agriculture, I did not want to press



them too hard to do so, since with Chief Howard claiming my various improved methods of insect control to have but a very limited value, they could not endorse my system of earwig control without stepping on Chief Howard's corns, which, if done, might cause them to get fired, and they knew they could not condemn what they knew to be valuable, without finally being shown up as deliberate liars. For details on this point see my free Circular No. 184-B. Thus, as far as I was concerned I took the stand that Chief Howard was due to shoulder his responsibility, instructing the college people to tell him what their tests had shown.

Earwigs can be easily controlled by several means and can also be easily actually exterminated in a given place, pending reinfestation from outside sources. One of these means, at not the all around best means at that, accomplishes control at practically no cost. If this can be done, then, accomplishing this much and nothing further, will stamp Chief Howard a liar when he says my means of control have only a most limited value. And to show I am right I will explain here this particular method of controlling earwigs.

Earwigs come forth to feed during the night and hide during the day. They decidedly congregate for feeding upon food plants naturally most attractive to them, or food plants rendered artificially more attractive than they normally are. Suppose the plants preferred in a given case are roses. Under the method in question, if you will mulch these roses with strawy manure, straw, lawn clippings or any kind of trash, the earwigs will, after feeding on the roses, hide mostly within this mulch. If you have poul-

try, even only one hen, all you have to do is to scatter the chicken feed into this mulch and the chicken will then find, search for and eat the earwigs in gathering the chicken feed. This method kept up for some time, of course, cleans out the earwigs. You do not have to be an entomologist to see that this method is sound. You also do not have to be specially shrewd to see that there was, under the circumstances, no excuse for any Congressman from the infested territory to drop his request for a show-down, unless satisfactorily shown otherwise by Chief Howard.

Since the method of earwig control above described presupposes the availability of poultry and the availability of some suitable food plant big enough to stand the scratching by the chicken, this method is not the all around best one, especially as it does not secure actual extermination, since some earwigs will live in houses. But it is a very good method on the farm and involves no real outlay in money, since the labor spent for mulching benefits the plants and thus pays for itself.

The Oregon college people, of course, were in duty bound to test this and other methods comprising my system of earwig control out, and report to Chief Howard, and, if of merit, ask for endorsement. Whether they did such a thing I do not know. What I do know, is, that Chief Howard had no use for information relative to a method of insect control of merit, if not emanating from official sources, even if it was submitted to him. He does not want to see anything good in any of the means I have evolved, thus incidentally of necessity giving the public a raw deal. He is knowingly and deliberately a scoundrel.

As there was a heavy increase in earwig nuisance of late years both in Seattle and Portland, the infestation in Seattle being older and heavier, with U. S. Representative F. T. Miller of Seattle having failed to take action, and our own district U. S. Representative M. E. Crumpacker of Portland, also deliberately doing nothing, I decided this spring the time had come to see, whether, after previous futile efforts to that end, U. S. Senator Wesley L. Jones, of Seattle, Wash., would not do something. Well, he made a request to the U. S. Secretary of Agriculture for an explanation on June 22 and on June 30 acknowledged receipt of a reply, sending a copy of same to me. This reply, as in all previous attempts to secure honest action, made no reference whatever to my methods of earwig control, but contained the usual bundle of lies which Chief Howard hands out to members of Congress making such requests, which lies, boiled down, mean a claim on his part, that my methods have but very little value, too little to have such an entomologist as Chief Howard waste any time discussing them. This dodging of the issue was the more inexcusable, as, knowing from 28 years' experience what a sneaky old weasel Chief Howard is, I had a special set of questions printed and sent for Chief Howard to answer. Copy on request.

Senator Jones was told by me this sort of thing would not do, and that we shall have to make Chief Howard attend to his business. Thereupon Senator Jones had the matter taken up anew through his Secretary at Washington, and under date of August 13 Chief Howard sent him a reply of which I was given a copy.

Chief Howard again declined to com-

ment on the means of earwig control as given in my Circular No. 182, issued in 1923, ignored the set of questions printed and held up to his entomologist nose, said this work is in charge of the State College of Agriculture at Corvallis, Ore., and the Oregon State Board of Horticulture and said "...Mr. Reinlein should push his remedial ideas with these organizations," thus passing the buck back to them. Well, I told them, as the case now stands, it is up to them to criticise my Circulars Nos. 182 and 184, both dealing with earwig control, the latter in connection with the control of numerous other insects. If they have found any hairs in the soup, thus far I have heard nothing of it. For a discussion of both the earwig and Japanese beetle problem write for my free Circular No. 184-H.

Show to an architect specifications and drawings of a proposed building, and he can tell you whether or not the work done that way will give satisfaction. Since Chief Howard is well known of having a hankering of being spoken of as an eminent entomologist and "the man with the analytical mind," he has to be able, even as plain U. S. Entomologist, to tell whether or not the means I describe are of any real value, substantiating any possible adverse comment by proper reasons. I have for years tried to convince the U. S. Presidents and Secretaries of Agriculture that what is needed in the interest of the public is, in effect, to put a ring in Chief Howard's nose and a rope on his hindleg to keep him from crawfishing away. This costs nothing and will save the public vast sums of money.

I also had, appearing as Circular No. 193-F, printed a set of questions relative to Japanese beetle control for

Chief Howard to answer. A copy was sent to Senator Jones and same was forwarded to Chief Howard. He is careful not to condemn my system of baiting, but claims such baits had been experimented with by his Bureau "for many years".... "and the development of geraniol as an attractant is the outcome of long experimentation and not at all due to any suggestion from Mr. Reinlein."

In my Circular No. 193-F Chief Howard was wanted to answer the question as to whether or not specially attractive fruits, such as wormy early sweet apples or peaches affected with brown rot, are not really the very best and cheapest source of geraniol, hence, used as described in my Circular No. 185, offer a far more practicable means of control than does geraniol as Chief Howard proposes to secure and use it. And another thing, when and where was it that Chief Howard published anything to that effect previous to 1 doing so in February, 1921? After someone has published the principle underlying a given method of control any one can come and claim to have found out the same.

This whole matter, concerning as it does the whole nation, was wanted by me all along to be fully investigated and suitably acted on by Congress, but Chief Howard as far back as 28 years ago did his best to block such a move.

The bundle of lies Chief Howard sent Senator Jones is concluded, as usual, with this statement: "This department is always ready to try out

promising suggestions coming from any source."

Now, as far as Japanese beetle control is concerned, my Circular No. 193 goes sufficiently into detail about the feeding habits of the beetles, the use of baits based upon these habits, about the attraction existing between the sexes as a means of concentration, and the use of sap of trees in connection with baiting for beetles feeding on tall trees, to leave no doubt to you that these suggestions at least are promising ones, but sneaky old weasel Howard wants to have nothing to do with them. The bundle of lies is simply Chief Howard's round-about way of saying I am too big a jackass to have any of my stuff even discussed. Experience has long ago shown Chief Howard that members of Congress are easily misled by his boastful general statements. He also knows very well that any specific statement squeezed out of him gives me that much more chance to force a show-down, and that, once a show-down is forced, he is lost.

Thus, as far as the people are concerned the question is just this. What do you like best? Would you rather dig down deeper in your jeans in the future than you did in the past to pay for the many deliberate sins, both of omission and commission, of Chief Howard, or would you rather chase your Congressman after the scoundrel and have him skinned alive?

FRED REINLEIN,

144 W. Kilpatrick St., Portland, Ore.

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The Corn Borer Problem

Fred Reinlein, 144 W. Kilpatrick St., Portland, Ore.

Circular No. 196-A

April 26, 1927



NOTHING of real value will ever be secured in the control of the European cornborer by the means the U. S. Department of Agriculture is just now following in its \$10,000,000 drive for "extermination or control" of the pest. The reasons for this are set forth somewhat at length in my Circular No. 195. Briefly stated, the main reasons are, that far too many larvae will escape any reasonable attempt to decimate the pest, since the borer hibernates in a great variety of locations, where it is not feasible to reach the larvae. With a female laying an average of 400 eggs, a comparatively few worms that escape destruction will then during the growing season, especially where there is more than one brood a year, so multiply, that damage will increase from year to year about the same. Moreover, as the borer works its way southward, it encounters not only a longer season, making possible the development of 3 and 4 broods respectively, but also can there hibernate in a great variety of living vegetation, such as winter oats, winter cover crops, fall, winter and spring truck crops, and sugar cane, making it practically impossible to get, even at any cost, any pronounced temporary relief from following the recommendations officially advocated.

Broadly speaking, the European cornborer can be cheaply controlled only by being attacked as moth and larva during the growing season. This can be secured by several distinct means, but in the majority of cases this is to be done through the judicious use of a system of baiting, evolved by me during the past 24 years. The cornborer-moths are rather roving in habits, and can readily be concentrated to specially attractive oviposition material, such as sweet corn. If the moths can be thus concentrated, you will readily see, that baiting need not be carried out all over the areas planted to field corn. Under my system of control the bait is very easily and cheaply made, and it is very easily applied directly to the plants that act as means of concentration, as for instance sweet corn, but even these

need not all be baited. This is made possible through employing, especially for large-scale work, additional means of concentration. These consist in the judicious use of light and of sweet smelling poisoned substances, used singly or, for better results, in combination. And destruction is secured not only through the use of poisoned baits, used, if the abundance of the moths warrant it, in several different ways and all at the same time, if such be desired for a quick clean-up of a badly infested locality, but also through the use of sticky substances, used in combination with either light or poisoned sweet smelling baits, or both. Still another means of attack and a very powerful means at that, is provided by the use of a gasoline torch, used as an insect trap at night. The cornborer can be readily controlled without the use of a gasoline torch, but the cornborer may be associated with insects for the control of which a gasoline torch, used as a trap at night, makes the best means of control, for billbugs, clickbeetles and cornroot worm beetles for instance, and this then also, properly done, destroys the cornborer in large numbers, making thus the means that ordinarily would be used less necessary of application.

The possibilities of the use of bait for insect control were realized in a more or less vague way by me as far back as in 1903, when I showed that the codling moth can be destroyed in large numbers by a very easy method of baiting. Dr. Howard, Chief of the U. S. Bureau of Entomology, then and ever since was wanted to either endorse this method or else show why it should not be endorsed. Chief Howard, who is shown in my Circular No. 195 and numerous other of my publications to be a scoundrel, a liar and a thief, deliberately sidestepped the issues as from time to time this and numerous other improved means of insect control evolved by me were brought to his notice for action. He knew I was right, but did not want to admit it. He wanted to steal it. This he recently did in his report for 1926, where he claims on page 3 to have evolved lately, through his assistants, that very system of controlling the codling moth I had described 23 years before, admitting, in effect, there that this method of control is giving promise of giving better results than do sprays. The same holds good relative to the control of the oriental peach moth. This matter of infringement of my copyrighted matter is discussed in detail in my Circular No. 195.

In 1921, in my Circular No. 161, I showed, that baits,

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judiciously used, make possible the easy control of the Japanese beetle. As in other matters, Chief Howard, the scoundrel, sidestepped the issue and never either endorsed or condemned this claim. But in his report for 1925 he claims in effect to have made this discovery independently 4 or 5 years after I had published my Circular No. 161. Details regarding this infringement are given at length in my Circular No. 193.

At present, in regard to cornborer control Chief Howard specifically makes the claim, that it is impossible to successfully attack the borer as either moth or larva during the growing season. He is as wrong here in failing to endorse my means of cornborer control, originally described in my Circulars No. 156, 166, 167 and 172, and now brought up to the minute in my Circular No. 196, as he was, when he failed to endorse the use of baits and other means evolved by me for the control of the codling moth and the Japanese beetle.

The \$10,000,000 cornborer campaign now under way will bring out the fact, although, quite likely, Chief Howard will try to hide it as long as possible by making evasive claims, as he has been trying all along in regard to cornborer and other insect control where he had little or nothing of value to offer, that the pest cannot be profitably fought by the official means recommended, and that ways must be found to attack the pest during the growing season as moth and larva.

Trap crops, such as late planted sweet corn or corn planted for fodder, properly managed, as provided for under my system, do help to control the pest, especially in the more northern latitudes now infested, where field corn requires the whole season to mature, and where, therefore, effective concentration to sweet corn is feasible throughout the season, but they, of themselves, do not go far enough to give satisfactory protection. Moreover, their use becomes more and more less feasible as the pest travels south, and find there a longer season, and becomes capable of producing 3 and 4 broods respectively. For then the pest will find cotton and cane to be highly attractive food plants, whence, because of the attractiveness of these plants, it is, on the whole, not practicable to draw them away by the use of trap crops, such as late planted sweet corn, or corn planted for fodder.

Circular No. 196 describes exhaustively not only how

to control the cornborer with ease in the localities where there are only 1 or 2 broods a year, but also shows how the cornborer can be controlled where there are 3 or 4 broods, and where cotton and cane is attacked. Moreover, it is there shown, that the means to be employed to control the cornborer on cotton do not involve the outlay of any extra money, but that this pest is simply incidentally controlled by following a method of controlling the cotton boll-weevil I had worked out during the past 24 years, and which is described in detail in my Circular No. 183, issued in 1923.

Under this system of controlling the bollweevil part of the tips of the plants are coated with poisoned sweets by a very easy, simple and inexpensive process I succeeded in evolving in 1921 as the result of an effort to find a practicable method to poison the Mexican bean beetle. Under this method, described in its essential features in Circular No. 196, the laborious coating with poison of the underside of all of the leaves of the bean plant for the destruction of the larvae is done away with, and advantage is taken of the habit of the adults to feed at the tips of the plants. These tips, or rather, part of them, are coated with poisoned sweets, and in such a way, that all waste of material, such as would occur were sprays or dust used, is avoided. A little material is thus made to go a long way, and, further, by various means of concentration, described in my Circular No. 171, beans are protected against this pest at very little cost. If interested, write for my free Circular No. 171-A.

This method is adaptable, it was soon seen, to the control of the bollweevil on cotton. It was also seen, that by this method of using poisoned sweets, it is possible to poison bugs, true bugs, such as the cottonfleabug, now becoming a great pest throughout the cotton belt, and the cottonstainer. Thus, if cotton is to be, for instance, protected against the bollweevil, part of the tips of the cotton plants are coated with poisoned sweets, and this without any waste. Enough sweets are to be used so that the insects to be poisoned will prefer to feed on the poisoned part rather than the unpoisoned part, hence, in turn, the need of only poisoning part of the tips.

This system of controlling the bollweevil is made operative throughout the whole season through a method of concentrating the weevils in the latter part of the season to certain rows, which are handled in such a way, that

treatment can be there given in the latter part of the season, no matter how dense or how tall the plants in the field at large may stand. Thus it becomes necessary only to treat that part of the field, where the weevils are concentrated. Chief Howard, the scoundrel, deliberately refused to endorse this method of concentration, when anyone knowing the habits of the weevil knows the principle involved is sound.

My Circular No. 196 shows that this method of concentration and destruction takes in the borer moth without any extra effort. Not only the borer moth, but also the cottonfleabug, the bollworm moth and numerous other cotton pests, and it will also, in due time, control that other great prospective pest, the pink bollworm moth, a matter fully discussed in my Circular No. 196.

Because it is not feasible to use traprows in cane fields, or use trap crops late in the season, due to the great attraction cane will then have for the cornborer, and also, because it is not feasible to destroy young larvae of the cornborer on cane to any great extent, a slightly different system of control is described for the control of the cornborer moth on cane. This system is designed with a view to incidentally also attack successfully the caneborer moth, the caneborer weevil, the cane beetle and other cane pests.

Also, in as much as a cornfield infested by the cornborer may be planted side by side with other crops, infested with other insects, requiring, for best results, the use of light, in the form of a lantern or a traptorch, this light being used in connection with sweet smelling bait or sticky substances, or both, it is shown there, how these means affect cornborer moths in adjacent cornfields, and how control there should be modified, because of the influence of light and smell on the cornborer moths.

For illustration is used a field of strawberries infested by the strawberry root weevil, or, rather, weevils, since there are 4 distinct varieties, with 2 or 3 varieties frequently working together and these differing quite a bit in habits. These species are quite troublesome in the strawberry fields of Oregon and adjacent territory. It is shown there, that the use of poisoned sweets and other means make a far better and cheaper means of control, than does the apple pomace bait of late officially advocated. Not only this, but this method of control also takes care of the strawberry rootbeetle, the crown miner and the crownborer, insects for which but little of practical value has been evolved. The

strawberry weevil, highly destructive in many sections of the country, is also very readily controlled by these means.

Or, suppose an alfalfafield, next to or near a field of corn or other crop attacked by the cornborer, is severely attacked by the alfalfa weevil, or some other of the several nightflying insects attacking alfalfa. The use of light, by either a lantern or a traptorch, is then usually the all around best means to control these pests, as is pointed out in detail in my Circular No. 178. This circular deals with the control of forage croppests, especially alfalfa and cloverpests and grasshoppers, and shows how this is done by easy means, that make superfluous the use of sprays and dusts and of broadcasted bait. If interested in the control of this class of insects, send for my free Circular No. 178-A.

The contents of my Circular No. 196, while dealing primarily with the control of the cornborer and, merely incidentally, with the control of certain other corn and graininsects, amenable to practically the same means of control, such as the cornearworm, the Angoumois grainmoth and the "black weevil," and dealing with the control of these insects not only under the conditions the cornborer now occurs, but will also later occur after it will have invaded the South, are, because the control of insects the cornborer is now liable to be directly or indirectly associated with or will be associated with is also discussed as far as the proper control of these associated insects affects cornborer control, of much value to growers in general, even if they are not now affected by the cornborer. The reason is, it is shown there, how the means necessary for the easy control of the cornborer under all sorts of conditions were evolved from other means I had long before worked out for the control of numerous other insects. Circular No. 196 has for its purpose to give correct means of cornborer control under virtually all the conditions that are apt to occur. And the control of insects the cornborer may be associated with is purposely not gone into further than is necessary for our present purpose. More detailed information relative to their control will be found in other circulars. Thus, my Circular No. 196 shows you how to control the cornborer and the Japanese beetle on cotton by the same means I had previously evolved for the perfect and exceedingly easy control of the cottonboll weevil, but the Japanese beetle on cotton should, for best results, if plentiful, be attacked also by bringing some other means of concentra-

tion and destruction into play, means that do not affect either the cornborer or the bollweevil, and these are therefore left out. For details on these points in Japanese beetle control see my Circular No. 185. Either Circular No. 196 or 185 will cost you 50 cents, but you can buy either, after paying 50 cents for one of the two, for 25 cents additional, as also any one of a number of other circulars dealing with the control of other insects. For instance, No. 183 deals in detail with bollweevil control, No. 171 with the control of the Mexican bean beetle, No. 188 deals with maggot control, the codlingmoth, the oriental peach moth, the apple tree borer, the peach tree borer, the leopard moth and borers in general, including barkbeetles and nutweevils, affecting orchard, shade and timber trees, No. 187, deals with orchard, shade and timber tree defoliators, as the gipsy-moth, the browntailmoth and the tent caterpillar. No. 176 deals with grain insects, No. 178 with forage crop insects, especially the alfalfa weevil, clover pests and grasshoppers. These latter are to be controlled by means far cheaper and better than using broadcasted bait. No. 191 deals with general insect control, with special reference to sucking insect control. No. 192 deals with the control of the cotton fleabug. No. 194 with the strawberry rootworm on roses under glass. No. 182 deals exclusively with the control of the European earwig, a pest troublesome about Portland, Ore., Seattle, Wash., and adjacent sections. No. 184 deals with the earwig as associated with other insects in garden and orchard, as for instance the cherry maggot, the codling moth, the peach root borer, fleabeetles, sawflies, snails, injurious butterflies and cutworms, giving distinct means to attack cutworms both as larvae and as adults, the various means in question being all suitable in the control of the earwig.

As to cutworm control, my Circular No. 196 goes well into details in regard to ridding a given section of the country of the larvae of nightflying injurious moths by attacking the adults that produce the larvae. The cutworm moth is one of many species of noctuid moths, all nightflying and all more or less pests. Thus, Circular No. 196 shows, how any electric light in a city can be made into an insect killing apparatus at virtually no cost. It is, of course, vastly better all around for general insect control to watch and see what injurious insects come to light and thus know what is going to happen, if these adults are not killed, than

to let them lay their eggs and then try to successfully attack the widely scattered larvae. The U. S. Bureau of Entomology has worked out nothing of value along this line. They simply were left behind by me years ago.

You can secure any three of my circulars for \$1.00, any five for \$1.50, and so on. If interested, send price by Post Office money order, or write for free literature, referring to the particular trouble you are interested in. Circular No. 196 contains 28 pages, $5\frac{1}{4} \times 7\frac{3}{4}$.

Circulars No. 193 and 195 are not for free distribution. They were written mainly for the purpose of showing up Chief Howard as a scoundrel to President Coolidge, Secretary Jardine and members of Congress and, to do this effectively, most of the original means of insect control evolved by me had to be discussed at length. No. 193 deals mainly with the Japanese beetle problem, while No. 195 deals with the cornborer problem. Free copies go to members of Congress, Governors of States, influential members of the press willing to work for a show down, heads of farmers' organizations and the like. You can have free copies, if you have your Congressman apply for same, same to be examined by him and then to be forwarded to you, thus showing that he and you take an interest in the public weal.

Just now Seattle and Portland, because the city fathers would not listen to me and have their Senators and Representatives in Congress force a show-down with Chief Howard relative to my means of earwig control, as given in my Circulars No. 182 and 184, are saddling a tax running into hundreds of thousands of dollars upon their cities, by making it mandatory under a state crop pest law to use broadcasted bait for the control of the earwig and of cutworms, when, by using certain easy means of concentration and destruction provided for under my system, there are vastly cheaper and better ways to do this work. In fact, earwigs, as is shown both in my Circulars No. 182 and 184, can be controlled, outdoors, by the use of poultry, without thus using either poison or bait or involving any expense. By this method, in a city, a single hen can be made to effect a saving running into thousands of dollars, and she will grow fat at the job besides.